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The social information processing model in child physical abuse and neglect: A meta-analytic review

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ABSTRACT

Background: Child maltreatment has been recently examined from a cognitive-behavioral perspective. The Social Information Processing (SIP) model specifies how parental cognitions can be associated with child physical abuse and neglect and suggests that maltreating parents do not adequately respond to the child's needs due to errors/bias in the cognitive processing of child-related information.

Objective: This study provides two separate meta-analytic reviews of research exploring the role of parents' socio-cognitive variables in shaping child physical abuse and child neglect, identifying the association of each SIP stage to these types of maltreatment.

Method: After a four-phase systematic literature search based in PRISMA with inter-judges' agreement, 130 effect sizes were extracted from the 51 studies selected.

Results: Overall, the effect sizes of the four cognitive stages of the model were significant for physical abuse and ranged from small (r = .190 for parents' interpretations of children's signals) to moderate (r = .315 for parents' perceptions of children's signals). Regarding neglect, only the overall effect of parent's preexisting schemata was significant but small in magnitude (r = .231).

Conclusions: The results of these multilevel meta-analyses support the general hypothesis that physically abusive parents may incur in biases in processing child-related information, but further research is still required regarding neglect. Theoretically this work is likely to provide a more solid framework to understand parental cognitions underlying child maltreatment with potential implications for evaluation and intervention with maltreating or at-risk parents.

1. Introduction

Parenting is one of the most complex and challenging human tasks (Kane, 2005), which is shaped by a set of biological processes, personality attributes, actual or perceived characteristics of the children, and contextual influences such as social situational factors, family background, socioeconomic status, and culture (Belsky & Jaffee, 2015; Bornstein, 2016). When one or several of these subsystems are compromised, the likelihood of maladaptive parenting in the form of child maltreatment increases (Cicchetti & Valentino, 2015).

Data from child protection services (CPS) and prevalence studies have been documenting the high number of children who are still victims of abuse and neglect (e.g., Jud, 2018). Moreover, the immediate and long-term impact of child maltreatment for the

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children is well known, as well as the serious consequences for their own development (Jaffee & Maikovich-Fong, 2011), for their families, and for their communities (e.g., Radford, Corral, Bradley, & Fisher, 2013).

The multitude of variables contributing to child maltreatment has for a long time been well captured by ecological models of parenting (e.g., Cicchetti & Valentino, 2015) emphasizing the importance of addressing the several systems that influence parental behaviors. Despite the popularity of these models, recent socio-cognitive approaches to parenting have also been emphasizing the role of cognitive information processing mechanisms in determining parental behaviors towards children (e.g., Johnston, Park, & Miller, 2018; Sigel & McGillicuddy-DeLisi, 2002), including those related to maladaptive parenting such as child abuse and neglect (e.g., Azar, Reitz, & Goslin, 2008; Crittenden, 1993; Crouch & Milner, 2005; Milner, 2000).

In the context of child physical abuse, Milner (1993), 2000) proposed a four-stage Social Information Processing (SIP) model to examine parental cognitions – (0) preexisting cognitive schemata, (1) perception and (2) interpretation of children's signals, and (3) selection and (4) implementation of a parental response, associated with this type of maltreatment. In the same year, Crittenden (1993) extended this approach to child neglect, proposing that abusive and neglectful parents cannot adequately respond to their child's needs because of errors or biases in information processing, particularly child-related information. The significant theoretical and empirical body of knowledge derived from these SIP models, and the valuable role of knowledge integration to science development, motivated the meta-analytic review of research exploring the role of parents' socio-cognitive variables in shaping child maltreatment presented in this manuscript.

Since the 80′s, socio-cognitive models explaining maladaptive parenting such as child abuse and neglect became more prominent. Overall, these models advocate the importance of the ways parents think about their children during parental-child interactions: "Mothers with flexible, complex, and appropriately differentiated schemas are better equipped to perceive the nuances of mother–child interaction and avoid biases in cue processing, leading to more efficient and competent parenting" (Azar et al., 2008, p.298). The seminal work by Sigel (1985), conceptualizing parent-child relationships research with a marked emphasis on cognitive processes and information processing, inspired subsequent work under this approach (e.g., Azar et al., 2008). Critically, recent meta-analyses confirmed the strength of these associations between parental cognitions and child maltreatment. For example, a meta-analytic review about the risk factors of child maltreatment (Stith et al., 2009) identified parents' perceptions about children as an important risk factor for abuse and neglect. Moreover, studies assessing cognitively based intervention programs, addressing changes in parental cognitions, have confirmed their effectiveness (e.g., Bugental, Corpuz, & Schwartz, 2012). Among the different socio-cognitive approaches to parenting (e.g., Azar et al., 2008), the SIP model applied to abuse (2003, Milner, 1993) and neglect (Crittenden, 1993) has reached some prominence. Based on information processing theories from social cognition, these models suggest that physically abusive and neglectful parents are unable to understand the signals or states of the child, interpret these signals correctly, and select and implement adequate responses due to bias and errors in processing caregiving related information. Although most of the SIP components proposed in the two models share many features, Crittenden's model of child neglect does not fully map onto each of the Milner's SIP components (namely, it does not discuss pre-existing schemata).

Specifically, the SIP framework proposed by Milner (2000) suggests that parents hold pre-existing cognitive schemas, including beliefs and values that influence the way they perceive and behave towards their children. These schemas act as a filter for the subsequent three cognitive stages – perception and interpretation of children's signals, response selection, and a final cognitive-behavioral stage where the response is implemented (physical abuse). Crittenden's model applied to child neglect proposes that neglectful parents fail to respond to children's signals, that are indicative of children's needs for care, because they do not perceive the signal, do not interpret the signal as requiring a parental response, are unable to select an adequate response or are unable to implement that response (Crittenden, 1993).

During the last decades, the SIP model has been receiving theoretical and empirical support (e.g., Azar, McGuier, Miller, Hernandez-Mekonnen, & Johnson, 2017; Rodriguez, Silvia, & Gaskin, 2019), documenting different socio-cognitive parental variables that influence parental caregiving behaviors.

In the SIP model applied to maladaptive parenting, pre-existing cognitive schemas are considered a key factor in cognitive information processing, defined as knowledge accepted as true by individuals (Sigel, 1985). When activated, this knowledge acts as a filter for the environmental information to which parents must respond (e.g., Azar et al., 2008). These schemas might include (a) ideas, beliefs, values and attitudes about child development and childrearing (Sigel & McGillicuddy-DeLisi, 2002), (b) person-specific schemata such as self-efficacy, control expectancies, locus of control orientation and empathy, and (c) affective schemata, such as mood, negative affect, distress, and hyperreactivity to child-related stimuli (Milner, 2000). These pre-existing schemata are likely to influence parents' perceptions of children's signals and behaviors, and to determine the subsequent stages of information processing (Bugental & Johnston, 2000; Milner, 1993). Specifically, these information structures, prior to the processing of new information, can be global (related to all children) or specific (related to their own children), theory-driven (based on preexisting beliefs) or context-driven (impacted by situational variables; Milner, 2000). Research conducted with high-risk of abuse and abusive parents has been showing that these parents are more likely to hold more inaccurate and biased preexisting cognitive schemata. For example, this research has shown that these parents value physical punishment as a disciplinary technique (e.g., Ateah & Durrant, 2005; Rodriguez, 2018; Wang, Wang, & Xing, 2018), hold unrealistic expectations about child development (e.g., Azar & Rohrbeck, 1986; Haskett, Scott, Willoughby, Ahern, & Nears, 2006; McElroy & Rodriguez, 2008), have negative implicit attitudes towards children (e.g., Risser, Skowronski, & Crouch, 2011), present higher accessibility of negative schemata (e.g., Crouch et al., 2012, Crouch, Risser et al., 2010; Hiraoka et al., 2014; Milner et al., 2011), show an external locus of control (e.g., Rodriguez, 2010; Rodriguez & Richardson, 2007), are less empathic (e.g., Francis & Wolfe, 2008; Pérez-Albéniz & De Paúl, 2003; Pérez-Albéniz & De Paúl, 2004), and present more negative affect (e.g., Bradley & Peters, 1991; Dadds, Mullins, McAllister, & Atkinson, 2003; Dopke, Lundahl, Dunsterville, & Lovejoy, 2003; Pérez-Albéniz & De Paúl, 2006). Surprisingly, much less attention has been given to neglectful parents. However, the research

conducted with neglectful parents has been suggesting that they present unrealistic expectations about child development (e.g., Azar et al., 2017; Azar, Stevenson, & Johnson, 2012; Gaines, Sandgrund, Green, & Power, 1978), an external locus of control (e.g., Rodriguez & Richardson, 2007), lack of empathy (e.g., De Paúl, Pérez-Albéniz, Guibert, Asla, & Ormaechea, 2008; Rodrigo et al., 2011), negative affect (e.g., Edwards, Shipman, & Brown, 2005) and biased attitudes related to parenting (e.g., Camilo, Garrido, & Calheiros, 2020).

The first stage of information processing proposed in the SIP model is parents' detection and perception of the child's signals and states (Milner, 2000). This stage includes attentional processes related with the child, such as awareness of children's behavior, encoding of child-related information, cue detection accuracy, notice of minor changes in children's behavior, likelihood to observe noncompliant children' behaviors, ability to distinguish different types of child transgressions, and errors in recognition of the child's emotional expressions. Specifically, research has been suggesting that high-risk and abusive parents present errors in encoding children's behavior (e.g., Crouch et al., 2017; Dopke et al., 2003; During & McMahon, 1991; Milner et al., 2011; Miragoli, Balzarotti, Camisasca, & Blasio, 2018) and in recognizing children's emotions (e.g., Asla, De Paúl, & Pérez-Albéniz, 2011; Francis & Wolfe, 2008; Rodriguez, Gracia, & Lila, 2016), and are more intolerant towards children's misbehavior (e.g., McElroy & Rodriguez, 2008). Neglectful parents are expected to have more difficulties in perceiving signals indicative of children's need for attention (Crittenden, 1993). Although scarce, a few studies have been suggesting that neglectful parents present errors in encoding children's behaviors (Hansen, Pallotta, Tishelman, Conaway, & MacMillan, 1989) and in recognizing children's emotions (Hildyard & Wolfe, 2007).

In stage 2 of the SIP model, influenced by parents' preexisting schemata and by their encoding of children's behavior, parents interpret and evaluate children's signals, and engage in attributional processes. These attributions of children's behavior might be more internal/external, stable/unstable, specific/global, controllable/uncontrollable, or intentional/unintentional (Milner, 2000). Specifically, high-risk and abusive parents are expected to display more negative and biased judgments about their children, to interpret their behaviors as more negative, wrong, and blameworthy, and to attribute them to internal, stable, and global child factors, often motivated by hostile intent. Further, they are expected to make more evaluations of wrongness and to have more expectations of child's compliance following transgressions. Research conducted with high-risk and abusive parents provides support for these assumption by showing that these parents make more negative attributions about children's behaviors (e.g., Crouch et al., 2017; Dopke & Milner, 2000; Mammen, Kolko, & Pilkonis, 2003; Rodriguez, 2018), interpret these behaviors as having negative intent (e.g., Ateah & Durrant, 2005; Azar et al., 2016), and have higher expectations of child compliance (e.g., Dopke & Milner, 2000; Rodriguez, Smith, & Silvia, 2016). Research with neglectful parents has shown that they make more negative attributions about children's behaviors (Hildyard & Wolfe, 2007) and interpret these behaviors as having negative intent (Azar et al., 2012, 2017).

In the third stage of the SIP model parents are expected to integrate the information and select a response. Parents use the situational information in their evaluation of children's behavior (mitigating information) and select from their repertoire, specific parenting skills and techniques, using their ability to creatively generate appropriate child management techniques (Milner, 2000). High-risk and abusive parents are expected to show more errors in the integration of child-related information, and their response selection process is likely to be limited by their poor repertoire of parental responses. For example, research has already shown that both abusive and neglectful parents present deficits in problem-solving skills (e.g., Azar et al., 2016, 2017; Azar et al., 2012), and that abusive parents specifically show a lack of adequate parenting techniques (e.g., Caselles & Milner, 2000; De Paúl, Asla, Pérez-Albéniz, & Cádiz, 2006; Letourneau, 1981; Russa, Rodriguez, & Silvia, 2014).

Finally, in the fourth response implementation and monitoring stage proposed in the SIP model, high-risk and abusive parents are likely to have less-developed skills to implement adequate responses, and to monitor and modify their response when necessary. While abusive parents are expected to engage in aggressive and violent behaviors (Milner, 2000), neglectful parents are expected to fail in implementing a parental response, omitting their caregiving behaviors (Crittenden, 1993).

The processes involved in the SIP stages are believed to influence each other in a bi-directional way, and to be moderated by experiences of negative affect and high levels of distress (2003, Milner, 1993). Furthermore, the SIP model proposed by Milner (2000) suggests that information processing activities are both controlled, especially in ambiguous and novel situations, and automatic, occurring outside of awareness and potentially influenced by the parents' responses to stress (physiological arousal) (Milner, 2003).

In the last decades, the SIP model or its components have been systematically used in the context of maltreatment research, examining different socio-cognitive variables, using explicit or implicit measures and more experimental or correlational designs. Recent research has also been exploring the model as whole, and applying longitudinal methods (e.g., Rodriguez et al., 2019).

The exponential growth of studies on parental cognitions during the last decades, examining the effects of different cognitive variables advances fundamental knowledge about the parental cognitions that are most associated with maladaptive parental behaviors. Further, more insight into the effects of parental cognitions underlying child abuse and neglect can help improve current risk and actual behavior assessment practices, namely disentangling the role of different sources of information (such as CPS records, self-reports, observations, implicit measures) in the assessment of parental practices. Third, while informing about the parental cognitions more associated with parenting behaviors, the results of the present study can support the development and improvement of prevention and intervention programs with abusive and neglectful parents. To summarize the research about parental cognitions that are associated with child physical abuse and child neglect, we conducted a set of meta-analyses based on the cognitive stages of the SIP model. Although the SIP framework underlying this review is originally a model applied to child physical abuse (Milner, 2000), we adopted the model to explore its application to neglect. Specifically, we aimed to identify the association of each SIP stage to physical abuse and to neglect. Additionally, we mapped the main characteristics of the studies, namely the sample characteristics, type of maltreatment, type of measures used to assess the socio-cognitive variables and maltreatment, country of data collection and publication year, and examined their moderation effects in the association between parental cognitions and child maltreatment. The flow diagram, the list of included studies and their main characteristics, the coding scheme, the classification of the SIP cognitive stages,

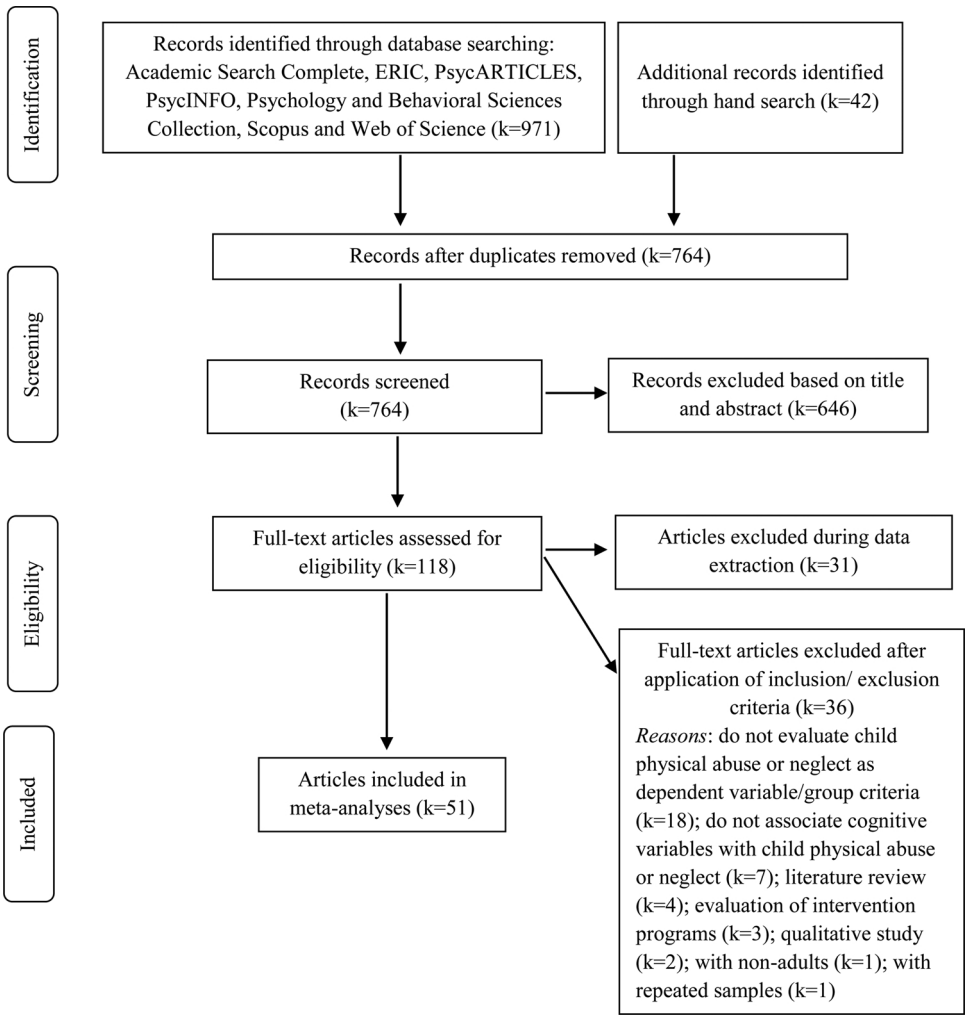

Fig. 1. Flow diagram of search results.

and the references included in the meta-analyses are presented in the Supplemental Material.

2. Method

2.1. Search strategy and study selection

A systematic electronic search was conducted during November 2018, in seven databases, namely Academic Search Complete, ERIC, PsycARTICLES, PsycINFO, Psychology and Behavioral Sciences Collection, Scopus and Web of Science, restricted to articles published in academic journals in English, Portuguese and Spanish. The studies were identified using all possible combinations of the following groups of search terms: (a) child abuse OR child neglect OR child maltreatment; AND (b) cognitive processes" OR "information processing" OR "sip model" OR cognitions; AND (c) parent*. Additionally, a hand search was performed based on the references of relevant papers and previous reviews of the literature on this subject.

Studies were considered for this meta-analysis if they met a set of inclusion criteria: (1) empirical and quantitative studies; (2) adult participants, with 18 years or older, parents or non-parents (e.g., undergraduate students, who were assessed for the risk of being maltreating in the future); (3) evaluated, as independent variables, socio-cognitive factors related to parenting and child-rearing underlying the SIP model of maladaptive parenting (according to Milner, 2000); (4) evaluated, as dependent variables, child physical abuse or child neglect, perpetrated (referred to CPS or assessed through parental reports) or at risk of. In a later stage, during data extraction, studies presenting only multivariate results were not considered since they do not present a direct association between two variables (see Appendix D in Supplemental Material).

According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Liberati et al., 2009), we conducted a four-phase process (Fig. 1) to select the relevant studies based on a sequential examination of the title, abstract and full text. Title and abstract screening were conducted by two independent judges in order to obtain inter-rater agreement, using the

software Rayyan QCRI (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016). Each rater screened all the articles identified (91.4 % of agreement), and all disagreements were resolved by a third rater. From the 1013 articles initially identified, 51 were selected and included in the meta-analysis (see Appendix A in Supplemental Material).

2.2. Coding of the studies

Based on the guidelines proposed by Lipsey and Wilson (2001), we created a form for coding the main studies' characteristics, their results and the specific data required to calculate the effect sizes (see Appendix B in Supplemental Material). Specifically, the following information was extracted: bibliographical information (authors; title; year of publication), sample characteristics (type of participants – mothers, fathers, non-parents; type of sample - CPS or community-sample; age-range of the children; sample size), study characteristics (country in which the study was conducted; design; assessment context), information about the variables (type of maltreatment; measures of maltreatment; socio-cognitive variables evaluated; social information processing stage; measures of the socio-cognitive variables), main results, and the respective effect sizes. The effect sizes that were not reported in the primary studies were calculated using statistical information derived from the reported statistics. Some of the variables were coded for descriptive purposes or to be tested as potential moderators. Additionally, based on Milner's proposal (2000), the socio-cognitive variables were classified according to the stages of the SIP model (see Appendix C in Supplemental Material).

2.3. Calculation of effect sizes

To quantify the effect of parental socio-cognitive factors in the explanation of child physical abuse and neglect, we calculated the Pearson product-moment correlation coefficient (r) for each association between a socio-cognitive variable (e.g., errors in emotions recognition, deficits in problem-solving skills) and a variable of abuse and neglect (e.g., CPS records, parental practices evaluation) that could be extracted from the primary studies. Pearson's product moment correlation coefficient (r) was chosen as the effect size because almost all the primary studies included were correlational studies, and because correlations are readily interpretable in terms of practical importance (Rosenthal & DiMatteo, 2001). Moreover, correlations can be easily computed from chi-square, t, F, and d values (Hunter & Schmidt, 2004), which proved to be helpful to transform the remaining statistics reported in primary studies (e.g., means, standard deviations, and odds-ratios).

Study-specific data were transformed to correlation coefficients using the methods and formulas proposed by Lipsey and Wilson (2001), and by Borenstein, Hegdes, Higgins, and Rothstein (2009)). Effect sizes were calculated using the results of bivariate analyses. Multivariate results such as adjusted means or adjusted odds-ratios were not considered since they do not present a direct association between two variables. We selected this approach, since the studies included in the meta-analyses rarely use the same set of covariates. This means that combining and comparing differentially adjusted effect sizes would limit the ability to properly estimate a true overall effect (see Mulder, Kuiper, van der Put, Stams, & Assink, 2018).

When the correlation coefficient is chosen as effect size, multiple scholars advise to transform correlations into normally distributed Fisher's z-values prior to conducting the statistical analyses in meta-analytic research. Correlations are not normally distributed, and this may negatively affect the results of the analyses (e.g., Cooper, 2010; Lipsey & Wilson, 2001). Therefore, all correlation coefficients were transformed into Fisher's z-scores prior to conducting the analyses. After the analyses, the Fisher's z-scores were transformed back to correlations in order to enhance the interpretability of the results. In the present study, effect sizes of $r > .100$ were interpreted as small, $r > .243$ as medium, and $r > .371$ as large (Rice & Harris, 2005). The direction of each effect size (either positive or negative) matched the statistical data as reported in the primary study.

2.4. Analyses plan

The primary studies included in the current review were treated as a random sample from a larger population of studies, and therefore, in the statistical analyses, a random-effect-approach was applied (see for example Mulder et al., 2018). Most of the included studies reported multiple socio-cognitive variables or physical abuse and neglect, meaning that, in many cases, multiple effect sizes could be extracted from one primary study. In order to take the dependency between effect sizes from the same study into account, we used an approach in which the (possible) dependence of effect sizes can be modeled. Therefore, we performed three-level meta-analyses for each SIP stage, where three different sources of variance are modeled: variance between studies (level 3), variance between effect sizes extracted from the same primary study (level 2), and sample variance of the retrieved effect sizes (level 1) (e.g., Assink et al., 2015; Mulder et al., 2018). The multilevel models allow the calculation of an overall effect size and, if significant variance on level 2 and/or level 3 is observed, to examine whether study and/or sample characteristics can explain this variance. The syntax described by Assink and Wibbelink (2016) was used to build the meta-analytic models in the statistical environment R (version 3.6.3, R Core Team, 2020), with the function "rma.mv" of the metafor package (Viechtbauer, 2010). The model coefficients were tested two-sided using the Knapp-Hartung-correction (Knapp & Hartung, 2003), meaning that a t-distribution was used for testing individual coefficients, and an F-distribution was used for the omnibus-test of all coefficients in the model (excluding the intercept). To determine the significance of the variances at levels 2 and 3, two one-sided log-likelihood-ratio tests were performed, in which the deviance of the full model was compared with the deviance of the model without one of the two variance-parameters. The sampling variance of the observed effect sizes (Level 1) was estimated by using the formula prosed by Cheung (2014). For each individual cognitive variable, a simple meta-analysis was performed with the function "rma" of the metafor package (Viechtbauer, 2010), whenever the number of effect sizes included allowed it (> 1).

Furthermore, a selective number of potential moderating variables were examined, based on previous studies (e.g., Hambrick, Tunno, Gabrielli, Jackson, & Belz, 2014; Lau, Valeri, McCarty, & Weisz, 2006). Prior to the moderator analyses, dummy variables were created for each category of all discrete variables and continuous variables were centered around their mean.

Finally, to examine the extent to which the results were affected by different sources of bias (such as publication bias), a non-parametric and funnel-plot based trim-and-fill analysis was conducted (e.g., Duval, 2005).

3. Results

3.1. Descriptives

The present review analyzed a total of K = 51 articles and 130 effect sizes (see Appendix A in Supplemental Material). Most studies were conducted in the USA (k = 33), followed by Europe (k = 12), and Canada (4), and single studies were conducted in Australia (k = 1) and China (k = 1). The 51 studies included were published between 1978 and 2018, although most of them (k = 35) were published after 2000.

The sample sizes of the included studies ranged from n = 20 to n = 1596 and included mostly mothers (k = 28) or mothers and fathers (k = 16), and a few studies included non-parents (k = 6). Samples were coded into referred to CPS-samples (k = 26), or community-based samples (i.e., samples with parents with non-referred children, and non-parents) (k = 25).

Regarding the type of maltreatment, most studies analyzed physical abuse (k = 47) and a smaller number of studies explored neglect (k = 10). Child maltreatment was assessed mostly through self-report measures (k = 32) or CPS records (k = 20).

Socio-cognitive variables were coded into the four-SIP stages, with the majority of studies analyzing stage 0 variables (k = 36), followed by stage 2 variables (k = 20), and finally stage 1 (k = 17) and stage 3 (k = 17). Stage 0 variables – *parents' pre-existing schemata* – included unrealistic expectations about the child's development (k = 13), lack of empathy (k = 12), negative affect (k = 9), value of physical punishment (k = 6), external locus of control (k = 4), accessibility of negative schemata (k = 2) and hyperreactivity to child-related stimuli (k = 1). Stage 1 variables – *parents' perceptions* – included errors in encoding children's behavior (k = 12), in recognizing children's emotions (k = 5) and intolerance towards children's misbehavior (k = 1). Stage 2 variables – *parents' interpretations and evaluations* – included general negative attributions (k = 8), attributions of negative intent (k = 6), evaluations of wrongness (k = 5), expectations of child compliance (k = 4), attributions of controllability (k = 2), errors in interpreting children's behavior (k = 1) and attributions of internality (k = 1). Stage 3 variables – *parents' information integration and response selection* – included lack of adequate parenting techniques (k = 12), deficits in problem-solving skills (k = 5), inadequate appraisals of the appropriateness of disciplinary choices (k = 2), and inadequate disciplinary goals (k = 1).

3.2. Overall effects of the SIP stages on physical abuse

The overall effect of each SIP stage and of each specific cognitive variable on physical abuse is presented in Table 1. Each overall effect represents the association of a SIP stage (or the individual cognitive variable) and child physical abuse. The overall effect of each of the four SIP stages was significant, with Stages 0 and 1 presenting moderate effects (r = 0.265 for *parents' preexisting schemata*, and r = 0.296 for *parents' perceptions*), and Stages 2 and 3 presented effects of smaller magnitude (r = 0.179, for *parents' interpretations and evaluations*, and r = 0.230, for *parents' information integration and response selection*).

Specifically, in Stage 0, the overall effect of most cognitive variables examined was significant and ranged from small (r = 0.191, for the *value of physical punishment*) to moderate (r = 0.357, for the *lack of empathy*); one of the effect sizes was not significant (*unrealistic expectations about child development*, r = 0.126). Regarding Stage 1, both individual cognitive variables (*errors in encoding the child's behavior* and *errors in recognizing children's* emotions) presented a significant and moderate effect size (r = 0.300, r = 0.275 respectively). In Stage 2, most of the effect sizes of the cognitive variables were small (with the exception to the *general negative attributions*, r = 0.265), and two of them were not significant (*attributions of controllability*, r = 0.104 and *errors in interpreting child's behavior*, r = 0.178). Finally, in Stage 3, two of the cognitive variables (*deficits in problem-solving skills* and *lack of adequate parenting techniques*) presented a significant and moderate effect size (r = . 327, r = 0.237 respectively), and the effect size of *inadequate appraisals of the appropriateness of disciplinary choices* (r = 0.070) was not significant.

3.3. Overall effects of the SIP stages on child neglect

Regarding neglect, the overall effect of each SIP stage and of each specific cognitive variable is presented in Table 2. Only the overall effect of Stage 0 was significant but small (r = 0.231) in magnitude; the overall effect sizes observed in Stage 2 and 3 were not significant (r = 0.255 and r = 0.288 respectively). Stage 1 was not meta-analyzed since only one effect was identified.

Specifically, in Stage 0, the overall effect of the two analyzed cognitive variables (*lack of empathy*, r = 0.104 and *unrealistic expectations about child development*, r = 0.226) was not significant. Regarding Stages 2 and 3, the individual cognitive variables examined (*attributions of negative intent* and *deficits in problem-solving skills*) presented a significant and moderate effect (r = 0.257, r = 0.288 respectively).

3.4. Heterogeneity and moderator effects

The results of the likelihood-ratio tests revealed significant variance between effect sizes extracted from the same study and

Table 1
Results for the overall mean effect sizes of the SIP stages in physical abuse.

SIP Stage/ cognitive variable	# Studies	# ES	Fisher's *z* (SE)	95 % CI	Sig. mean z (*p*)	Mean *r*	% Var. level 1	Level 2 variance	% Var. level 2	Level 3 variance	% Var. level 3
Stage 0	32	47	.271 (.052)	0.167, 0.376	< .001***	.265	8.16	.015***	17.85	.061*	74.00
Unrealistic expectations about child development	11	12	.127 (.080)	−0.030, 0.283	.112	.126					
Lack of empathy	11	11	.374 (.107)	0.164, 0.584	< .001***	.357					
Negative affect	8	8	.308 (.114)	0.085, 0.531	.007**	.299					
Value of physical punishment	6	9	.193 (.050)	0.095, 0.291	< .001***	.191					
External locus of control	4	4	.246 (.083)	0.083, 0.409	.003**	.241					
Accessibility of negative schemata	2	2	.224 (.081)	0.065, 0.383	.006**	.220					
Hyperreactivity to child-related stimuli	1	1	–	–	–	–					
Stage 1	17	18	.305 (.043)	0.214, 0.396	< .001***	.296	42.22	.017	57.78	.000	7.01
Errors in encoding the child's behavior	12	12	.310 (.062)	0.188, 0.432	< .001***	.300					
Errors in emotion recognition	5	5	.282 (.055)	0.173, 0.390	< .001***	.275					
Stage 2	18	28	.181 (.037)	0.105, 0.257	< .001***	.179	33.22	.023***	66.78	.000	2.39
General negative attributions	8	9	.272 (.082)	0.112, 0.433	< .001***	.265					
Attributions of negative intent	4	4	.150 (.067)	0.018, 0.281	.026*	.149					
Evaluations of wrongness	5	5	.242 (.059)	0.127, 0.357	< .001***	.237					
Expectations of child compliance	4	4	.114 (.045)	0.027, 0.202	.011*	.114					
Attributions of controllability	2	3	.104 (.089)	−0.070, 0.278	.243	.104					
Errors in interpreting child's behavior	1	2	.180 (.131)	0.077, 0.438	.170	.178					
Stage 3	15	19	.234 (.061)	0.105, 0.362	.001**	.230	20.00	.017	29.79	.028	50.21
Lack of adequate parenting techniques	12	13	.242 (.064)	0.116, 0.368	< .001***	.237					
Deficits in problem-solving skills	3	3	.340 (.095)	0.155, 0.525	< .001***	.327					
Inadequate appraisals of the appropriateness of disciplinary choices	2	2	.070 (.209)	−0.339, 0.479	.736	.070					

Note. # Studies = number of studies; # ES = number of effect sizes; SE = standard error; CI = confidence interval for Fisher's *z*; Sig. mean *z* = level of significance of mean effect size; Mean *r* = mean effect size (Pearson's correlation); % var = percentage of variance; Level 2 variance = variance between effect sizes within studies; Level 3 variance = variance between studies.
* $p < 0.05$; ** $p < .01$; *** $p < .001$.

Table 2
Results for the overall mean effect sizes of the sip stages in neglect.

SIP Stage/ cognitive variable	# Studies	# ES	Fisher's *z* (SE)	95 % CI	Sig. mean z (*p*)	Mean *r*	% Var. level 1	Level 2 variance	% Var. level 2	Level 3 variance	% Var. level 3
Stage 0	7	10	.235 (.009)	0.012, 0.458	.041*	.231	14.62	.000	1.70	.063	85.38
Unrealistic expectations about child development	5	5	.230 (.140)	−0.045, 0.504	.101	.226					
Lack of empathy	3	3	.104 (.111)	−0.114, 0.231	.350	.104					
Negative affect	1	1	–	–	–	–					
External locus of control	1	1	–	–	–	–					
Stage 1	1	1	–	–	–	–	–	–	–	–	–
Stage 2	3	3	.261 (.065)	−0.018, 0.540	.057^{+}	.255	100.00	.000	0.0	.000	0.0
General negative attributions	1	1	–	–	–	–					
Attributions of negative intent	2	2	.263 (0.69)	0.128, 0.398	< .001	.257					
Stage 3	4	4	.296 (.101)	−0.024, 0.616	.061^{+}	.288	46.86	.010	26.57	.010	26.57
Deficits in problem-solving skills	4	4	.296 (.101)	0.099, 0.493	.003**	.288					

Note. # Studies = number of studies; # ES = number of effect sizes; SE = standard error; CI = confidence interval for Fisher's *z*; Sig. mean *z* = level of significance of mean effect size; Mean *r* = mean effect size (Pearson's correlation); % var = percentage of variance; Level 2 variance = variance between effect sizes within studies; Level 3 variance = variance between studies.

$^{+}$ $p < 0.10$; * $p < 0.05$; ** $p < .01$.

Table 3
Results for categorical and continuous moderators (bivariate models) – physical abuse.

SIP cognitive stages	Moderators	# Studies	# ES	Intercept (95 % CI) / mean *z* (95% CI)	Mean *r*	*β* (95% CI)	*F* (df1, df2)[a]	*p*[b]	Level 2 variance	Level 3 variance
Stage 0.	*Sample type*						0.445 (1, 45)	.508	.015***	.064*
	Community-based (RC)	18	29	0.240 (0.098, 0.383)	.235					
	Referred to CPS	15	18	0.311 (0.153, 0.469)	.301	0.071 (-0.284, 0.142)				
	Measure of maltreatment						2.980 (1, 44)	.091[+]	.017***	.051
	CPS records (RC)	9	9	0.420 (0.221, 0.619)	.397					
	Self-report	23	37	0.223 (0.109, 0.338)	.219	−0.197 (-0.426, 0.033)				
	Measure of cognitions						2.661 (1, 45)	.110	.012**	.065*
	Implicit (RC)	5	6	0.156 (-0.023, 0.334)	.155					
	Self-report	30	41	0.287 (0.180, 0.394)	.279	0.131 (-0.031, 0.293)				
	Country of data collection						1.243 (2, 44)	.298	.014***	.061*
	USA (RC)	20	30	0.217 (0.090, 0.344)	.214					
	Europe	8	10	0.322 (0.125, 0.519)	.311	0.105 (-0.112, 0.322)				
	Others	5	7	0.422 (0.156, 0.687)	.399	0.205 (-0.089, 0.499)				
	Publication year	32	47	0.277 (0.171, 0.382)	–	−0.005 (-0.014, 0.005)	1.055 (1, 45)	.310	.015***	.062*
Stage 2.	*Sample type*						0.770 (1, 26)	.388	.022***	.001
	Community-based (RC)	8	16	0.211 (0.108, 0.313)	.208					
	Referred to CPS	10	12	0.143 (0.022, 0.264)	.142	−0.068 (-0.226, 0.091)				
	Measure of maltreatment						0.491 (1, 25)	.490	.023***	.001
	CPS records (RC)	7	8	0.137 (-0.016, 0.291)	.136					
	Self-report	11	19	0.199 (0.104, 0.293)	.196	0.061 (-0.119, 0.241)				
	Measure of cognitions						2.327 (1, 26)	.139	.018*	.000
	Implicit (RC)	2	2	0.000 (-0.251, 0.251)	.000					
	Self-report	17	26	0.195 (0.121, 0.269)	.193	0.194 (-0.068, 0.456)				
	Country of data collection						1.264 (2, 23)	.301	.022***	.000
	USA (RC)	13	20	0.177 (0.089, 0.265)	.175					
	Europe	2	3	0.319 (0.066, 0.573)	.309	0.142 (-0.126, 0.410)				
	Others	3	3	0.052 (-0.187, 0.290)	.052	−0.125 (-0.379, 0.129)				
	Publication year	18	28	0.186 (0.107, 0.265)	–	−0.002 (-0.012, 0.007)	0.282 (1, 26)	.600	.023***	.000

Note. # Studies = number of studies; # ES = number of effect sizes; Mean *r* = mean effect size (*r*); CI = confidence interval; *β* = estimated regression coefficient; RC = reference category; Level 2 variance = variance between effect sizes within studies; Level 3 variance = variance between studies.

[+] $p < 0.10$; * $p < 0.05$; *** $p < .001$.

[a] Omnibus test of all regression coefficients in the model.

[b] p-value of the omnibus test.

Table 4
Results for the overall mean effect sizes of the sip stages in physical abuse after conducting trim and fill analyses.

SIP Stage	# Studies	# ES	Fisher's *z* (SE)	95 % CI	Sig. mean z (*p*)	Mean *r*
Stage 0	43	58	.330 (.040)	0.252, 0.408	< .001***	.319
Stage 1	22	23	.387 (.048)	0.293, 0.481	< .001***	.369
Stage 2	26	36	.106 (.037)	0.033, 0.179	.004**	.106
Stage 3	–	–	–	–	–	–

Note. # Studies = number of studies; # ES = number of effect sizes; SE = standard error; CI = confidence interval for Fisher's *z*; Sig. mean *z* = level of significance of mean effect size; Mean *r* = mean effect size (Pearson's correlation).
*$p < .05$; ** $p < .01$; *** $p < .001$.

between studies (i.e., level 2 and level 3 variance) in Stage 0 and Stage 2 for physical abuse (and not for neglect) (see Table 1). Consequently, we conducted moderation analysis for both stages. None of the variables tested in the moderator analyses yielded a significant effect, as presented in Table 3.

3.5. Trim and fill analyses

The trim and fill analyses suggested that bias was present in most of the SIP stages in physical abuse and neglect, given the asymmetrical funnel plot distributions observed (Appendix E in Supplemental Material). After the trim and fill analyses, the overall effects were adjusted by imputing "missing" effect sizes and re-estimating an overall effect, presented in Tables 4 and 5. For physical abuse, higher effects were observed for Stages 0 and 1, whereas Stage 2 presented smaller effects. For neglect, a higher effect was found in Stage 2 and a smaller effect was found in Stage 3.

4. Discussion

From a cognitive-behavioral perspective, parents undergo a set of socio-cognitive processes that influence their parental responses (e.g., Sigel & McGillicuddy-DeLisi, 2002). The SIP model applied to child maltreatment suggests that abusive and neglectful parents are unable to understand the signals or states of the child, interpret those signals correctly, and select and implement adequate responses (2003, Crittenden, 1993; Milner, 1993). Several authors have already empirically explored this framework and provided evidence that parental cognitions have an important role in shaping abusive and neglectful behaviors (e.g., Crouch, Milner et al., 2010; Pérez-Albéniz & De Paúl, 2005; Rodriguez, Smith, & Silvia, 2016). To further examine the extent to which specific components of the SIP model explain child physical abuse and child neglect, we reviewed 51 primary studies (and their effect sizes) that examined the association between socio-cognitive parental variables from each cognitive stage of the SIP model and physical abuse and neglect, using a multilevel meta-analytic approach.

The results of our meta-analyses support the general hypothesis that physically abusive parents may incur in biases or errors in child-related information processing during parent-child interactions. Overall, the associations of socio-cognitive parental variables with physically abusive practices reached a small (Stages 0 and 1) to medium magnitude (Stages 2 and 3) (according to Rice & Harris, 2005). Regarding neglect, only parents' preexisting schemata revealed a significant, although small, association with child neglect, which can be potentially related with the low number of included studies analyzing child neglect. This finding suggests the need for further studies examining parental neglect within this framework. Although non-significant, parents' biased interpretations and evaluations of children's behavior (Stage 2) and their difficulties to integrate the information and select a parental response (Stage 3) reached a moderate effect in the association with child neglect.

As for the specific cognitive variables in each stage and their associations with child maltreatment, the obtained results suggest that abusive parents are more likely to hold inaccurate and biased preexisting cognitive schemata (Stage 0), namely they present a more external locus of control (e.g., Ellis & Milner, 1981; Rodriguez, 2010; Rodriguez & Richardson, 2007), lack of empathy (e.g., Francis & Wolfe, 2008; Milner, Halsey, & Fultz, 1995; Rodrigo et al., 2011), and higher negative affect towards children (e.g., Dadds et al., 2003; Edwards et al., 2005).

Further, the included studies suggest that physically abusive parents present more difficulties in perceiving children's signals

Table 5
Results for the overall mean effect sizes of the sip stages in neglect after conducting trim and fill analyses.

SIP Stage	# Studies	# ES	Fisher's *z* (SE)	95 % CI	Sig. mean z (*p*)	Mean *r*
Stage 0	–	–	–	–	–	–
Stage 1	–	–	–	–	–	–
Stage 2	5	5	.271 (.055)	0.164, 0.378	< .001***	.265
Stage 3	6	6	.193 (.098)	0.001, 0.384	.049*	.191

Note. # Studies = number of studies; # ES = number of effect sizes; SE = standard error; CI = confidence interval for Fisher's *z*; Sig. mean *z* = level of significance of mean effect size; Mean *r* = mean effect size (Pearson's correlation).
* $p < .05$; ** $p < .01$; *** $p < .001$.

(Stage 1), making more errors when encoding children's behaviors (e.g., Graham, Weiner, Cobb, & Henderson, 2001; McCarthy et al., 2017; Miragoli et al., 2018; Stringer & La Greca, 1985; Webster-Stratton, 1985), and when recognizing children's emotions (e.g., Balge and Milner, 2000; Francis and Wolfe, 2008; Rodriguez, Garcia, et al., 2016).

Additionally, with a smaller magnitude, the reported results also indicate that physically abusive parents make more biased attributions about children's behaviors (Stage 2), interpreting those behaviors as more negative (e.g., Montes, De Paúl, & Milner, 2001; Rodriguez & Tucker, 2015) and as more wrong (e.g., Chilamkurti & Milner, 1993).

Finally, the reviewed results also suggest that physically abusive parents may present more difficulties in the integration of child-related information and response selection (Stage 3), revealing difficulties in problem-solving (e.g., Azar et al., 2016, 2017) and a limited repertoire of adequate parenting techniques (e.g., De Paúl, Pérez-Albéniz et al., 2006; Russa et al., 2014).

The included studies also suggest that biases on parents' preexisting schemata may have an important role in the explanation of neglectful behaviors, namely that they present unrealistic expectations about child development (e.g., Azar et al., 2012). Moreover, neglectful parents make more biased attributions about children's behaviors (Stage 2), interpreting those behaviors as more negative (e.g., Azar et al., 2017; Larrance & Twentyman, 1983) and present more difficulties in problem-solving skills (e.g., Azar, Robinson, Hekimian, & Twentyman, 1984).

The trim and fill analyses for physical abuse and neglect suggested missing data in most of the SIP stages, indicating that the true effects of each stage may differ from the estimated effects in our meta-analyses. Although previous studies on simulated meta-analyses showed that the trim-and-fill algorithm may inappropriately adjust for bias (e.g., Peters, Sutton, Jones, Abrams, & Rushton, 2007), it is useful to test how sensitive the results are to the possible presence of publication bias (e.g., Fernández-Castilla et al., 2019). In this specific case, the results of trim and fill analyses even reinforced the effects in most stages.

Despite the interesting results of this meta-analytic review, we have identified a set of limitations in the primary studies. First, many of the included studies were conducted with no reference or recognition of the SIP framework applied to abuse and neglect (e.g., Rodrigo et al., 2011) and used different terms for the same variables (e.g., "mother's rating of the valence of the child behavior" in Dadds et al., 2003; "parents' perceptions of children's adjustment" in Haskett, Scott, Grant, Ward, & Robinson, 2003). Nevertheless, we attempted to overcome this limitation through a thorough categorization of the variables based on the theoretical descriptions of the SIP model (2003, Milner, 1993). Second, there is high variability in child abuse and neglect definition and assessment. For example, CPS records may have inherent biases derived from professionals' perceptions, different legal systems of each country, or lack of distinction between reported and substantiated cases. Moreover, self-report measures of maltreatment were very heterogeneous, since some evaluated parental practices such as the *Parent- Child Conflict Tactics Scale* (Straus, Hamby, Finkelhor, Moore, & Runyan, 1998) for abuse and the *Multidimensional Neglectful Behavior Scale - Parent Report* (Kantor, Holt, & Straus, 2003) for neglect, and others assessed risk with the *Child Abuse Potential Inventory* (Milner, 1986). Third, few studies explored child neglect, which is consistently reported as the most prevalent type of maltreatment (e.g., Warmingham, Handley, Rogosch, Manly, & Cicchetti, 2019). Further, not all primary studies report having controlled for socio-demographic variables. For example, many of the studies did not refer to socioeconomic status (e.g., Crouch et al., 2012), which can constitute an important confound since poverty has been also associated with cognitive information processing deficits (Mani, Mullainathan, Shafir, & Zhao, 2013). Finally, and despite the recognizable difficulty in accessing and evaluating these samples, few studies have used experimental designs (for an exception see Farc, Crouch, Skowronski, & Milner, 2008), and even less conducted longitudinal research (for an exception see Rodriguez et al., 2019).

Likewise, we have identified some limitations of the current meta-analyses. Specifically, the reported work did not include non-published studies (for details about this issue see Camilo & Garrido, 2019), although the diagnosis analysis for publication bias indicated that our results are reliable. In addition, a significant number of studies ($k = 31$; see the reference list in the Appendix D in Supplemental Material) were not included since they presented only multivariate data. Moreover, this review does not specify the different types of child neglect (neglect, emotional, educational neglect), mostly because the primary studies did not treat neglect as a multidimensional construct, presenting global scores for this type of maltreatment. It would be important to disentangle the association of different parental cognitions with different types of neglect and abuse, for a deeper understanding of the different putative causal mechanisms. Also, the inclusion of studies with small samples, and subsequently low power, is likely to increase the effects of publication bias (e.g., Turner, Bird, & Higgins, 2013). Further, this meta-analytic review did not include an assessment of study quality (e.g., *STROBE*; Vandenbroucke et al., 2007), which could be a potential moderating variable. Additionally, the current study draws mostly on correlational data, which do not allow to establish causation. Finally, although the analytical distinction of the SIP components is crucial to clarify the model, these components are interdependent and mutually influenced (2003, Milner, 1993), and might be addressed as such in future research.

Nevertheless, the current multilevel meta-analytic review brings important theoretical and methodological contributions in summarizing the evidence about socio-cognitive processes underlying child physical abuse and neglect. This is likely to reflect the advances in both social cognitive psychology and social developmental psychology in the parenting domain. Specifically, by systematically addressing the different socio-cognitive components of the social information processing model, this work is likely to provide a more solid framework to understand parental cognitions underlying child maltreatment. Based on the current findings, future studies on child neglect are needed, especially because this has been the most reported and substantiated type of maltreatment (Kim, Mennen, & Trickett, 2017). Further, it would be important to consider abuse and neglect as multidimensional constructs, analyzing and presenting the results for each specific form of abuse and of neglect, given their potential different mechanisms (Warmingham et al., 2019). Given the high co-occurrence of different types of maltreatment (Kim, Wildeman, et al., 2017), future studies should also control for the co-occurrence of abuse and neglect. Moreover, the current study identified a limited number of longitudinal and experimental studies, which are important to establish causality (e.g., Rodriguez et al., 2019). Finally, future

research could advance on the validation of implicit measures that tap unconscious and automatic cognitive processes, less prone to conscious awareness and social desirability than self-report measures (Lau et al., 2006).

Regarding the implications to intervention, this review clarifies the most important components of the SIP model that should be addressed in prevention and intervention with maltreating or at-risk parents. For example, based on the reported effect sizes, parental pre-existing schemata and perceptions about children's signals seem to be important components to integrate in intervention programs with parents (e.g., Camilo & Garrido, 2013). This can easily be translated into programs targeting parents' beliefs and attitudes about childrearing, increasing positive parental expectations about their capabilities, their meta-cognitive awareness, and working their attentional focus management, reducing the automaticity of their cognitions (Crouch & Milner, 2005).

Socio-cognitive approaches to maladaptive parenting constitute an important complement to the bio-ecological frameworks (Belsky & Jaffee, 2015), by focusing on parental cognitions that, under certain environmental conditions, may lead to maltreating parental behaviors. This meta-analytic review shows that parental cognitions have an important role in the explanation of child physical abuse and neglect while opening new research avenues. These may include more experimental designs and the use of implicit measures (Camilo, Garrido, & Calheiros, 2016). Additionally, the examination of mediation effects between the components of the model, with the interaction of ecological factors (e.g., socioeconomic status, social support, child-related stress) and individual variables (e.g., psychopathology, cognitive functioning) (e.g., Azar et al., 2012; Milner, 2000; Rodriguez et al., 2019) are also likely to benefit prevention and intervention programs in child maltreatment.

Declarations of Competing Interest

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.chiabu.2020.104666.

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