Revista Argentina de Clínica Psicológica
2020, Vol. XXIX, N°5, 601-610
DOI: 10.24205/03276716.2020.1057



# NEUROPSYCHOLOGICAL IMPLICATIONS OF CHILD SEXUAL ABUSE: A LITERATURE REVIEW

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**ABSTRACT**

As reported in the literature, childhood maltreatment may impair proper cognitive development, which in later years can cause significant and lasting damage. The purpose of this study is to conduct a systematic review of the studies that link alterations in executive functions and sexual abuse in childhood. The sample involved articles indexed in PubMed and Web of Science that were identified through a selection of different keywords. The 430 articles found were finally reduced to nine that met our inclusion criteria. There are few studies presenting results on the impact of this type of maltreatment. Besides, it calls for future studies that include variables that have not been considered in previous *studies.*

**Keywords:** Child sexual abuse. Childhood development. Psychological stress. Executive function. Child maltreatment.

## INTRODUCTION

Child maltreatment can modify both the brain's function and its structure (Cohen, Grieve, Hoth, Paul, Sweet, Tate et al., 2006; Dannlowski, Stuhrmann, Beutelmann, Zwanzger, Lenzen, Grotegerd et al., 2012; De Bellis, 2005; Grassi-Oliveira, Ashy, & Stein, 2008; Grassi-Oliveira, Gomes, & Stein, 2011; Lupien, McEwen, Gunnar, & Heim, 2009; Navalta, Polcari, Webster, Boghossian, & Teicher, 2006; Yates, Carlson, & Egeland, 2008), altering the path of its development, increasing the risk of mental disorders in later years, and impacting on the neurocognitive function (Pluck, Lee, David, Macleod, Spence, & Parks, 2011; Davis, Moss, Nogin, & Webb, 2015). The most common deficits observed refer to language, visuospatial ability, intelligence, motor skills, and executive functions (Davis, Moss, Nogin, & Webb, 2015). These impairments in neurodevelopment may lead to problems of a psychosocial, academic, behavioural, and neuropsychological nature (Pluck, Lee, David, Macleod, Spence, & Parks, 2011; Davis, Moss, Nogin, & Webb, 2015), as well as to affective deficits (De Bellis, Hooper, Spratt, & Woolley, 2009; De Bellis, Woolley, & Hooper, 2013; Vasilevski & Tucker, 2016; Veltman & Browne, 2001). Although there are studies that do not find any kind of cognitive impairment caused by child maltreatment (Jacobs, Kennedy, & Meyer, 1997; Veneziano, Veneziano, LeGrand, & Richards, 2004), the vast majority report a significant relationship between the two variables (De Bellis, Hooper, Spratt, & Woolley, 2009; Spann, Mayes, Kalmar, Guiney, Womer, Pittman et al., 2012). The impact of child maltreatment among adolescents may be seen in tasks that require cognitive flexibility, divided attention, working memory, and planning skills (Spann, Mayes, Kalmar, Guiney, Womer, Pittman et al. 2012, Veneziano, Veneziano, Legrand, & Richards, 2004; Mezzacappa, Kindlon, & Earls, 2001), while this impact among adults is also readily apparent in task-solving problems (Navalta, Polcari, Webster, Boghossian, & Teicher, 2006; Brandes, Ben-Schachar, Gilboa, Bonne, Freedman, & Shalev, 2002; Stein, Kennedy, & Twamley, 2002; Twamley, Hami, & Stein, 2004). The numerous perspectives and findings reported in different studies entail the need to synthesise the evidence in order to reach robust conclusions that encompass information about the state-of-the-art.

The hypothalamic-pituitary-adrenal axis (HPA) is the main system involved in stress response because its activation increases the production of glucocorticoids (GCs), which in turn link up to their specific receptors all over the brain. The activation of the complex of GC receptors acts as a transcription factor that can have a negative effect on the regulation of the gene expression. An increase in GC production due to stress may impact upon the structure and function of the cerebral

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regions involved in regulating the release of GCs (Lupien, McEwen, Gunnar, & Heim, 2009). Cortisol and GCs are important substances for proper functioning, but the influence of stress may render them toxic through excess (Johnson & Velastegui, 2017). The amygdala, the hippocampus, the cerebellum, the prefrontal cortex, the corpus callosum (Edalati & Krank, 2015) and the sympathetic nervous system (Davis, Moss, Nogin, & Webb, 2015) are the most vulnerable regions to early-life stress because they are the ones with the highest density of GC receptors (Teicher, Andersen, Polcari, Anderson, & Navalta, 2002).

The HPA's main function is to detect threats or stressful factors, and once it has done so to trigger a neurochemical response that ends when the threat disappears (Dackis, Rogosch, Oshri, & Cicchetti, 2012). Prolonged maltreatment in childhood may lead to a chronic alteration of cortisol levels that interferes with the HPA's performance (Tarullo & Gunnar, 2006), weakening its response to the threat (Carpenter, Carvalho, Tyrka, Wier, Mello, Mello et al. 2007). Some studies report a link between the damage to these regions of the brain and cognitive deficits in intelligence, attention, working memory, and executive functions (Hart & Rubia, 2012). The amygdala assigns an emotional value for providing a behavioural response to it accordingly. Prolonged exposure to a stressful stimulus may deregulate the amygdala's activity and, because of the incorrect assignment of emotional values, prompt stress responses to non-threatening stimuli (Cohen, Perel, DeBellis, Friedman, & Putnam, 2002). The hippocampus is involved in emotion and the consolidation of memory. This area is extremely vulnerable to a high level of GCs because it destroys the neurons in the hippocampus (Johnson & Velastegui, 2017), reducing the hippocampal volume and being associated with a deficient cognitive performance, especially with memory impairment (Lupien, de Leon, de Santi, Convit, Tarshish, Nair et al., 1998). The cerebellum is involved in motor control and the emotional regulation of fear and pleasure (Edalati & Krank, 2010). Children with post-traumatic stress syndrome record a reduction in this brain structure (DeBellis, Keshavan, Shifflett, Iyengar, Beers, Hall, & Moritz, 2002; DeBellis & Kuchibhatla, 2006). Early-life stress is also linked to alterations in normal development and to the malfunctioning of the prefrontal cortex (PFC) (Carrion, Weems, & Reiss, 2009), impairing executive functions, language, speech and attention. There is a lesser integration of the hemispheres and reduced laterality in cases of early-life stress (Edalati & Krank, 2015). The damage in the integration of the cerebral hemispheres is linked to cognitive impairment, especially affecting visuospatial ability and motor skills.

Neuroimaging studies on children affected by maltreatment corroborate the aforementioned relationship between the regions and cognitive impairment (Hart & Rubia, 2012). The damage is greater in the executive function, language and speech, visuospatial ability, motor capacity, memory, attention and intelligence. *Executive functions* consist of multiple capabilities, such as inhibition, cognitive flexibility, self-control, control of emotions, working memory and attention; key processes for priming and undertaking target behaviours in an appropriate manner (Op den Kelder, Van den Akker, Geurts, Lindauer, & Overbeek, 2018). Exposure to maltreatment in childhood may impact upon executive functions right through until adulthood (Grassi-Oliveira, Gomes, & Stein, 2008), whereby early-life stress is associated with their abnormal development (Pechtel & Pizzagalli, 2011). *Speech and language* have an important role to play in other areas of development and in cognitive functioning. Speech deficits may be considered a marker of the delay in neurological development linked to maltreatment (Davis, Moss, Nogin, & Webb, 2015). *Visuospatial ability* and *motor skills* are factors that have an influence on childhood development, including academic success and social performance (Davis, Moss, Nogin, & Webb, 2015). The loss of hippocampus volume recorded in adulthood has been associated with stress in adolescence and neurogenesis inhibition in the dentate gyrus of adult rats when exposed to chronic stress (Lupien, McEwen, Gunnar, & Heim, 2009). The alterations of the hippocampus arising from childhood maltreatment may cause a dysfunction of the *memory and its processes*, including problems in the consolidation of the most traumatic frameworks and the intrusion of traumatic memories (Bremner, Vermetten, Afzal, & Vythilingam, 2004). There are experts that contend that psychological abuse and domestic violence constitute a major predictor of deficits in working memory, verbal recovery, and attentional skill that are reflected in adulthood (Dodaj, Krajina, Sesar, & Šimić, 2017). Childhood maltreatment has been linked to an *attention deficit,* amongst others (Hart & Rubia, 2012), observing a major impact in such settings as the home, school or work (Goodwin, Gudjonsson, Sigurdsson, & Young, 2011). The types of maltreatment that seem to have the biggest

impact on the low scores in *intelligence* include early institutionalisation (Pollak, Nelson, Schlaak, Roeber, Wewerka, & Wiik, 2010) and neglect (De Bellis, Hooper, Spratt, & Wooley, 2009; Kendall-Tackett & Eckenrode, 1996), as well as physical abuse (Carrey, Butter, Persinger, & Bialik, 1995) and sexual abuse (Perez & Widom, 1994). They have also been linked to a low intelligence quotient and delayed development in children (Edalati & Krank, 2015).

The comorbidity of different kinds of maltreatment may be a common phenomenon in which children are simultaneously exposed to different types of abuse (Pears, Kim, & Fisher, 2008). This exposure may cause more severe damage than a single type of repeated maltreatment, even in the case of sexual abuse (Mothes, Kristensen, Grassi-Oliveira, Fonseca, de Lima Argimon, & Irigaray, 2015). Nevertheless, some studies refute this hypothesis, contending that those children exposed to a certain type of severe maltreatment may suffer more damaging consequences than those exposed to different types of abuse (Finkelhor, Ormrod, Turner, & Hamby, 2005; Hildyard & Wolfe, 2002).

Emotional, physical or sexual abuse has a slightly greater impact than neglect on visual memory, executive functions, and working memory. Furthermore, sexual abuse seems to be linked to more pronounced deficits in visual working memory, whereas when the type of maltreatment involved is neglect, there are greater deficits in emotional processing and the speed of processing (Gould, Clarke, Heim, Harvey, Majer, & Nemeroff, 2012).

This review has involved perusing the studies published to date and summarising their findings as regards the following research question, following the PICO format (Liberati, Altman, Tetzlaff, Mulrow, Gotzsche, Ioannidi, Clarke, Devereaux, Kleijnen, & Moher, 2009): Do those people that have been exposed to sexual abuse in childhood, as opposed to those who have not, manifest any form of subsequent impact on their cognitive development?

## METHOD

This systematic review involved a protocol with different methodological considerations, format and guidelines for the drafting and publication of such reviews according to the PRISMA[1] statement (Moher, Shamseer, Clarke, Ghersi, Liberati, Petticrew, Shekelle, & Stewart, 2015). The PRISMA statement requires the identification of the publication, in this case as a systematic review. In keeping with the same statement, a structured abstract has been provided at the start, with the reasoning behind the need to address the topic. According to the different stages of a systematic review set out by PRISMA (identification, screening, eligibility and inclusion) the final selection consisted of nine of the initial 430 articles, chosen as follows: a systematic literature review has been conducted in March 2020 by locating e-articles in those journals available in the PubMed and Web of Science databases. The search has involved the combination of the following descriptors: "Child sexual abuse"; "Sexual abuse"; "Sexual abuse of child"; "Child development"; "Cognitive development"; "Executive function", and "Neuropsychological development".

Following a reading of the corresponding abstracts from PubMed (193 articles) and Web of Science (237 articles), a selection was made of those that met the single inclusion criterion for their full reading, namely, to be an empirical study. Nevertheless, the following studies of this nature were discarded: a) those that analysed other kinds of maltreatment besides sexual abuse in childhood and did not differentiate in the sample, and b) those involving a sample with psychopathologies (depression, schizophrenia, etc.). The final selection involved 34 articles (18 from PubMed and 16 from Web of Science). After checking for any coincidences between the two databases, we were left with 26 articles.

Once the 26 articles had been carefully read, the decision was made to discard 17 of them because of the inclusion and/or exclusion criteria used. This meant that our review finally consisted of nine articles.

Consistent with the PRISMA statement, the process of reviewing and extracting the results from the selected articles was followed by their individual portrayal and summarisation. Finally, this review sought to present a summary of the evidence together with the limitations of both the studies reviewed and the review itself

## RESULTS

Most of the studies reviewed coincide in stating that sexual abuse in childhood is linked to cognitive deficits in children and young adults (Bengwasan, 2018; Biedermann, Meliss, Simmons, Nöthling, Suliman, & Seedat, 2018; Feeney, Kamiya, Robertson, & Kenny, 2013; Marques, Belizario, Rocca, Saffi, de Barros, & Serafim, 2013; Navalta, Polcari, Webster, Boghossian, & Teicher, 2006;

[1] *Preferred Reporting Items for Systematic Reviews and Meta-Analysis*

Raskin, 1997; Rivera-Vélez, González-Viruet, Martínez-Taboas, & Pérez-Mojica, 2014). Although different significances are forthcoming, two of the selected articles do not find that sexual abuse has a negative impact on potential deficits (Dunn, Busso, Raffeld, Smoller, Nelson, Doyle, & Luk, 2016; Nikulina & Widom, 2013). Nevertheless, these latter findings may be explained by the limitations we shall be discussing in due course.

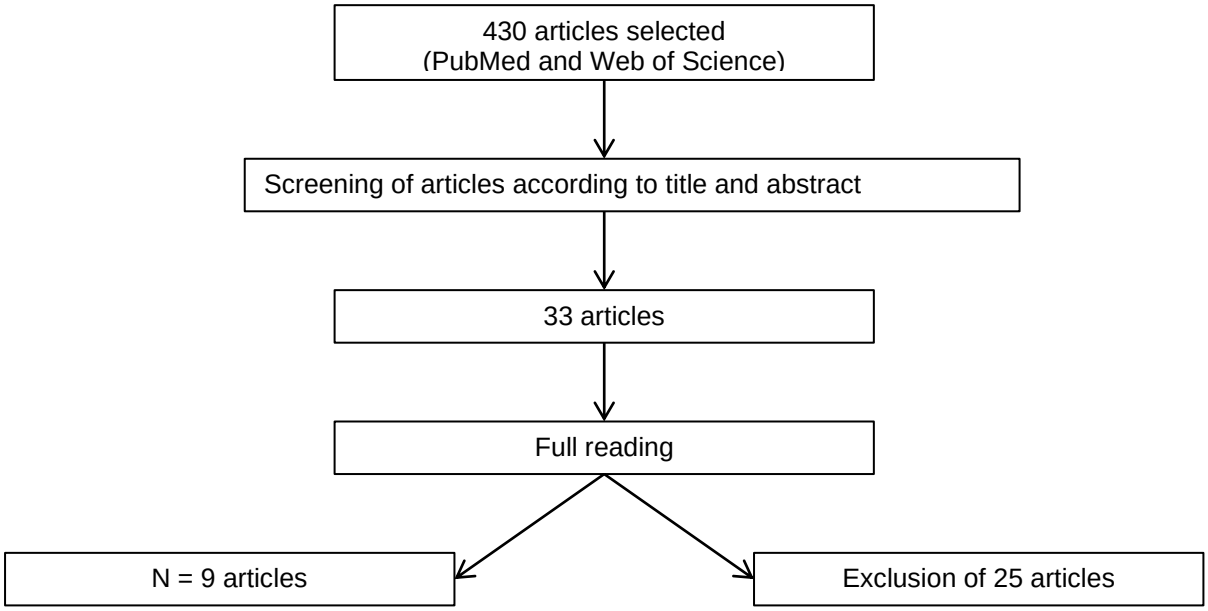


Figure 1. **Procedure and results of the literature review.**

The nine studies under review can be divided into two groups depending on the sample evaluated. There are six studies whose sample comprises adults that have experienced sexual abuse in childhood (Dunn, Busso, Raffeld, Smoller, Nelson, Doyle, & Luk, 2016; Feeney, Kamiya, Robertson, & Kenny, 2013; Navalta, Polcari, Webster, Boghossian, & Teicher, 2006; Nikulina & Widom, 2013; Raskin, 1997; Rivera-Vélez, González-Viruet, Martínez-Taboas, & Pérez-Mojica, 2014), while the sample in the three remaining studies involves minors that are still at risk (Bengwasan, 2018; Biedermann, Meliss, Simmons, Nöthling, Suliman, & Seedat, 2018; Marques, Belizario, Rocca, Saffi, de Barros, & Serafim, 2013).

The studies involving minors still at risk have mainly found that sexual abuse has had an impact on functions such as attention and memory, while it has not been found to have any effect on aspects such as language and speech (Biedermann, Meliss, Simmons, Nöthling, Suliman, & Seedat, 2018; Marques, Belizario, Rocca, Saffi, de Barros, & Serafim, 2013). Furthermore, only two of these three studies investigate executive functions, and only one finds significant differences in the performance of these functions among children with a history of sexual abuse compared to those with no such history (Marques, Belizario, Rocca, Saffi, de Barros, & Serafim, 2013). Bengwasan (2018) has explored solely the influence of child sexual abuse on intelligence, and the results reveal a significant difference in this area compared to other studies in which no significant results are forthcoming (Marques, Belizario, Rocca, Saffi, de Barros, & Serafim, 2013). Regarding the studies conducted with a sample of adults, the areas in which sexual abuse has the biggest impact are memory (Navalta, Polcari, Webster, Boghossian, & Teicher, 2006), executive functions (Raskin, 1997), and memory and executive functions (Feeney, Kamiya, Robertson, & Kenny, 2013; Rivera-Vélez, González-Viruet, Martínez-Taboas, & Pérez-Mojica, 2014). None of them has found differences in intelligence, attention, visuospatial ability or language. Most of the studies under review investigate attention and memory, while language, speech and visuospatial ability are the areas least explored.

Two of these nine studies have reported unusual results that have attracted our attention. Dunn, Busso, Raffeld, Smoller, Nelson, Doyle, and Luk (2016) have explored the impact that child sexual abuse has on memory in a sample of 484 individuals; the results do not point to significant differences between the group that has suffered abuse and the control group. Nevertheless, significant differences have been found between the group with a history of sexual abuse depending

on the age at which it occurred: those children that suffered the abuse between the ages of three and five record higher scores in numerical memory than those that suffered the abuse between the ages of 14 and 17. This may be explained by the neuroplasticity of younger children. These findings show how important it is to conduct studies that take into account the age at which the child has been maltreated. On the other hand, Feeney, Kamiya, Robertson, and Kenny (2013) have studied the impact that child sexual abuse has on memory, attention and executive functions in a sample of 501 individuals over the age of 50. Significant differences are found in executive functions and attention, yet they are not the ones expected. Both executive functions and attention record a better performance among those individuals that have been the victims of sexual abuse in childhood. These authors state that these findings may be due to the participants' age, whereby the fact that the sexual abuse is not so recent may mean a lesser impact on their lives. In any case, they call for a replicate study or similar research to explain these results. The following table provides a summary of the findings reported by all the articles under review:

*Table 1.* **Studies on the impact of child sexual abuse on cognitive functions.**

| Author, year | N | AS. (mean) | SM. Age range (mean) | DM. Years (mean) | EEFF | S&L | VA | M | A | I |
|---|---|---|---|---|---|---|---|---|---|---|
| Bengwasan, 2018 | 100 | 4 - 17 | < 17 | --- | --- | --- | --- | --- | --- | + |
| Biedermann et al., 2018 | 34 | 11 – 19 | < 18 | --- | - | - | --- | + | + | --- |
| Dunn et al., 2016 | 484 | 24 - 32 | < 17 | --- | --- | --- | --- | -** | --- | --- |
| Feeney et al., 2013 | 501 | >50 | < 18 | --- | +* | --- | --- | +* | - | --- |
| Marques et al., 2020 | 24 | 7 - 12 | < 12 | --- | + | - | - | + | + | - |
| Navalta et al., 2006 | 26 (F) | 18 - 22 | 2 – 15 (6.3) | 1 – 10 (3.2) | --- | --- | --- | + | - | --- |
| Nikulina et al., 2013 | 60 | 32 - 49 (41.2) | 0-11 | --- | - | --- | - | --- | --- | - |
| Raskin, 1997 | 10 (F) | --- (35.2) | 1 – 9 (4.5) | 5 – 20 (16.5) | + | - | - | - | - | - |
| Rivera-Vélez et al., 2014 | 12 (F) | 21 – 35 (29.33) | --- | --- | + | --- | - | + | - | - |

Notes. AS= Age range of the sample; SM= Start of maltreatment; DM= Duration of maltreatment; EEFF= Executive Functions; S&L= Speech & Language; VA= Visuospatial ability; M= Memory; A= Attention; I= Intelligence; + = Sexual abuse has a significant influence on neuropsychological variables; - = Sexual abuse has no significant influence on neuropsychological variables; --- = Not reported; F = Females; * = The relationship found reveals that neuropsychological variables perform better in response to sexual abuse in childhood; ** = There are no differences compared to the group that had not suffered sexual abuse, but there are in terms of the age when the abuse occurred (ages three to five, better numerical memory compared to those exposed between the ages of 14 and 17).

**DISCUSSION**

Child sexual abuse is independent of culture and society, which means it affects a significant number of children throughout the world, with serious ramifications for the victims' physical and mental health. Many experts agree that sexual abuse in childhood increases the risk of suffering from certain psychopathologies, but it also has a significant impact on cognitive development (Bengwasan, 2018; Biedermann, Meliss, Simmons, Nöthling, Suliman, & Seedat, 2018; Feeney, Kamiya, Robertson, & Kenny, 2013; Marques, Belizario, Rocca, Saffi, de Barros & Serafim, 2013; Navalta, Polcari, Webster, Boghossian, & Teicher, 2006; Raskin, 1997; Rivera-Vélez, González-Viruet, Martínez-Taboas, & Pérez-Mojica, 2014). The findings observed in the various studies reveal a link between a history of maltreatment in childhood and the development of certain parts of the brain, and therefore of sundry cognitive functions. The neurobiological consequences of early-life stress include a high level of catecholamines (epinephrine, norepinephrine and dopamine), corticotropin, cortisol, and serotonin (Teicher, Andersen, Polcari, Anderson, & Navalta, 2002; Wilson, Hansen, & Li, 2011; De Bellis, Keshavan, Spencer, & Hall, 2000; De Bellis, Spratt, & Hooper, 2011; Kirsch, Wilhelm, & Goldbeck, 2011; Lupien, Fiocco, Wan, Maheu, Lord, Schramek, & Tu, 2005; Twardosz & Lutzker, 2010).

As we have seen, child maltreatment has been linked to a reduction in the size of the cerebral cortex and subcortical structures, right temporal lobe, and corpus callosum (De Bellis, Keshavan, Shifflett, Iyengar, Beers, Hall, & Moritz, 2002 [Supports alterations in the right temporal lobe and corpus callosum]; Teicher, Dumont, Ito, Vaituzis, Giedd, & Andersen, 2004 [Supports alterations in the corpus callosum]). with neuroimaging of the adult brain revealing a clear decrease in the neural connections in the frontal and temporal lobes associated with childhood trauma (Gold, Sheridan, Peverill, Busso, Lambert, Alves, Pine, & McLaughlin, 2016), Other authors have reported alterations in EEG coherence between brain hemispheres in adults reporting childhood trauma compared to subjects reporting adulthood trauma or no past trauma (Cook, Ciorciari, Varker, & Devilly, 2009). As we have already noted, moreover, there are areas that are especially vulnerable to the consequences of child maltreatment, with some of the main ones being the prefrontal cortex, corpus callosum, cerebellum, hippocampus (Pechtel & Pizzagalli, 2011; Wilson, Hansen, & Li, 2011; De Bellis, Baum, Birmaher, Keshavan, Eccard, Boring et al., 1999) and amygdala (McEwen, 2008; Vyas, Mitra, Rao, & Chattarji, 2002). These same authors stress that these areas of the brain affected by maltreatment in childhood are linked to dysfunctions such as the alteration of cognitive functions (correlated mainly with the prefrontal cortex), or language alterations (correlated with the left cerebral cortex, including the corpus callosum and cerebellum) (Kavanaugh, Holler, & Selke, 2015). Nevertheless, this damage not only occurs at cognitive level, as the capacity for resilience is also limited regarding future stressors (Cross, Fani, Powers, & Bradley, 2017). Martin, Kidd, and Seedat (2009) report that the poor development of the executive functions and processing speed, as well as a lower score in intelligence, is associated with the interaction between a propensity toward anxiety and maltreatment in childhood.

Firstly, it would be convenient to conduct studies with broad samples, as so far many of them have consisted of populations of between 10 and 26 subjects, and those using bigger cohorts report findings that attract our attention. Secondly, and also regarding the sample, we find that some studies consist solely of women, meaning that it is important for future studies to consist of both men and women and, moreover, it might be expedient to compare the results for both sexes to check for any differences. ("On the other hand" is used when the author is presenting a different or even a contradictory perspective; in this case, the authors added another important limitation that needs to be considered by future studies, so "On the other hand" doesn't quite well fit here), In turn, the samples should be representative of the different socioeconomic echelons in order to extrapolate the findings to families with a low, medium and high status. Another of the limitations that are most cited, and which should be considered in future studies, is the need to use suitable batteries or scores to evaluate abuse or maltreatment in childhood in a broad and thorough manner, gathering data on the age at which the maltreatment occurred and how long it lasted, as well as clearly differentiating the type of maltreatment suffered, whereby this variable can be defined and delimited.

Our systematic review encountered a series of limitations, one of which involves the small number of studies that met the criteria for inclusion. This mean that our sample of articles was somewhat restricted. Furthermore, another of the main limitations we faced was that the bulk of the studies found did not differentiate between or include different types of child maltreatment and did not focus solely on sexual abuse. The broad array of terms used to refer to executive functions and the wide range of executive functions existing meant that this, too, was a difficulty that our review had to address. Following a review of the different studies, it was a challenge to reach certain clear conclusions due to the samples' overall lack of homogeneity. The samples compared were very different in terms of sex, age, etc. One of the key variables that turned out to be a limitation, and which we consider needs to be taken into account in future studies, involves everything that has gone on between the abuse and the pertinent assessment, as the time elapsed between one and the other, the duration of the maltreatment, and whether or not there has been any treatment, etc., could be influencing the different results obtained.

This review concludes that the various studies' findings are disparate and that the greatest consensus involves the influence this type of abuse has on factors such as attention, memory and executive functions. Nevertheless, this field has still not been thoroughly explored, and more studies need to be undertaken to consider the various limitations of prior research. It is important to understand the state-of-the-art and conduct studies that will explain how the different kinds of maltreatment and early-life stress have an impact and what their consequences are for neurological development and cognitive functions, and doing so

by taking into account the limitations of prior studies and using due and proper assessment instruments.

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