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How Do Parents Influence Child Disruptive Behavior After Acquired Brain Injury? Evidence From a Mediation Model and Path Analysis

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Objectives: Children with acquired brain injury (ABI) can present with disruptive behavior, which is often a consequence of injury and parent factors. Parent factors are associated with child disruptive behavior. Furthermore, disinhibition in the child also leads to disruptive behavior. However, it is unclear how these factors interact. We investigated whether parental factors influence child disruptive behavior following ABI and how these factors interact. **Methods:** Parents of 77 children with ABI participated in the study. Parent factors (executive dysfunction, trait-anxiety), potential intervention targets (dysfunctional parenting practices, parental stress, child disinhibition), and child disruptive behavior were assessed. A hypothetical model based on the literature was tested using mediation and path analysis. **Results:** Mediation analysis revealed that child disinhibition and dysfunctional parenting practices mediated the association of parent factors and child disruptive behavior. Parents' executive dysfunction mediated the association of dysfunctional parenting practices, parental stress and parent trait-anxiety. Parenting practices mediated the association of executive dysfunction and child disruptive behavior. Path analysis indices indicated good model adjustment. Comparative and Tucker-Lewis Index were >0.95, and the root mean square error of approximation was 0.059, with a chi-square of 0.25. **Conclusions:** A low level of parental trait-anxiety may be required to reduce dysfunctional parenting practices and child disinhibition. Impairments in child disinhibition can be exacerbated when parents present with high trait-anxiety. Child disinhibition is the major contributor of disruptive behavior reported by parents and teachers. The current study provides evidence of parent anxiety and child disinhibition as possible modifiable intervention targets for reducing child disruptive behavior. (*JINS*, 2019, *25*, 237–248)

Keywords: Acquired brain injury, Parenting, Executive functions, Anxiety, Children and behavior

INTRODUCTION

Acquired brain injury (ABI) is defined as damage that occurs beginning 28 days after birth. It has different degrees of severity and is the result of various factors, such as oxygen deprivation, substance abuse, stroke, infections, or a traumatic brain injury (TBI), and affects emotional, cognitive, and physical aspects, temporarily or permanently (McKinlay et al., 2016). Children with ABI can present with disruptive behavior that has been related to injury and family factors (Durish et al., 2018; Ganesalingam, Sanson, Anderson, & Yeates, 2007; Rao et al., 2009).

Specifically, family factors such as parents' mental health, parents' executive functions, and dysfunctional parenting practices have an impact on the child's long-term development after ABI (Greenham et al., 2015; Ryan et al., 2016; Wade, Zhang, Yeates, Stancin, & Taylor, 2016). We aimed to test the mediation of potential intervention targets (parental stress, child disinhibition, parenting practices) between parent factors (trait-anxiety, executive dysfunction) and child disruptive behavior after pediatric ABI. This study advances knowledge by using mediation and path analysis to examine potential intervention targets, parent factors, and child disruptive behavior together in a single model. To date, interventions overlook parent factors that could be involved in treatment outcomes. Investigating these factors together may lead to the detection of potential intervention targets to reduce disruptive behavior after ABI.

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Parenting Practices

Parenting practices were included as a potential intervention due to their modifiability. Parenting practices can be conceptualized by three dimensions: (1) warmth, which refers to fostering self-regulation by supporting the child's needs and demands; (2) behavioral control, which involves providing clear expectations for behavior together with appropriate limits; and (3) autonomy support, which involves encouraging children to formulate their perspective and goals (Braumind, 1971; Prinzie et al., 2003; Prinzie, Stams, Dekovic, Reijntjes, & Belsky, 2009).

Based on these dimensions, parenting styles can be classified into authoritative, authoritarian, permissive, and uninvolved styles (Siegler et al., 2017). The authoritative parenting style balances between the warmth/responsiveness, control/demandingness, and autonomy/support dimensions (Siegler et al., 2017). In typically developing children, optimal outcomes are evident when parents present authoritative parenting practices (Amato & Fowler, 2002). In contrast, dysfunctional parenting practices, such as authoritarian, permissive, and uninvolved practices can interfere with the child's development (Amato & Fowler, 2002). Implementation of authoritative parenting practices reduced disruptive behavior after childhood ABI in the home settings (Chavez-Arana et al., 2017; Durish et al., 2018; Greenham et al., 2015; Rashid et al., 2014; Root et al., 2016).

However, studies in the field of pediatric ABI have encountered difficulties when attempting to investigate if authoritative parenting practices foster reduced disruptive behavior in school settings due to the lack participation from school staff (Brown, Whittingham, Boyd, McKinlay, & Sofronoff, 2014). To date, the results from a pilot study (Chavez-Arana et al., 2017) and a randomized controlled trial (Chavez-Arana, Catroppa, Yáñez-Téllez, et al., 2018) suggest that the implementation of authoritative parenting practices does not reduce disruptive behavior in school settings.

Parent's Trait-Anxiety

It is common for parents of children with ABI to experience high levels of anxiety. Anxiety is experienced during situations perceived as threatening and is accompanied by negative expectations and concerns (Eysenck, Derakshan, Santos, & Calvo, 2007; Gu, Huang, & Luo, 2010). Trait-anxiety indicates excessive levels of worry (Aktar, Nikolic, & Bögels, 2017). Parents with high trait-anxiety experience more parental stress, tend to make pessimistic interpretations, report more negative life events, and are more intolerant (Gu et al., 2010; Pluess, Bolten, Pirke, & Hellhammer, 2010). A high trait-anxiety undermines parents' ability to initiate and maintain warmth interactions with the child and may lead to intrusive and overprotective parenting practices (Prinzie et al., 2009). Parents with high trait-anxiety tend to attribute negative intentions to their children when they misbehave, which may increase parental stress (Gu et al., 2010; Pluess et al., 2010; Prinzie et al., 2009).

High levels of trait-anxiety in parents may hinder the development of children's executive functions (Henrichs et al., 2011). Similarly, children who present with behavioral disinhibition in early childhood are more likely to present with trait-anxiety during adolescence (Lewis-Morrarty et al., 2015). Trait-anxiety has been associated with failures in the development or functioning of the central nervous system and genetic and environmental factors (Aktar et al., 2017; Henrichs et al., 2011; Lewis-Morrarty et al., 2015; Verkhratsky & Parpura, 2014). These neurological, environmental, and genetic factors may explain why trait-anxiety runs in families (Aktar et al., 2017).

Parental Stress

Parental stress is defined as the level of stress experienced in the parenting role and derived from the parent's interaction with the child (Abidin, 2012). Parents of children with ABI present with elevated parental stress, perhaps as a consequence of the diagnosis, treatment process, and concerns regarding their child's future (Hawley, Ward, Magnay, & Long, 2009; Micklewright, King, O'Toole, Henrich, & Floyd, 2012; Muscara et al., 2015; Prigatano & Gray, 2007). Parents' vulnerability may intensify as they face academic, behavioral, and social challenges associated with brain injury, such as the need for rehabilitation, advocacy, and additional support (Jordan & Linden, 2013; Micklewright et al., 2012; Prigatano & Gray, 2007).

Parent's Executive Dysfunction

Anxiety also has a detrimental effect on executive functions (Eysenck et al., 2007; Shields, Moons, Tewell, & Yonelinas, 2016). Executive functions are the cognitive processes involved in the conscious control of thought and action (Zelazo, Qu, & Kesek, 2010). Parents require executive functions to respond appropriately to their child's needs, require cognitive flexibility to switch responses across situational demands, and working memory to temporarily store and manipulate information about the parent–child interaction (Barrett & Fleming, 2011). Parents' executive functions influence their parenting skills (Bridgett, Burt, Edwards, & Deater-Deckard, 2015; Bridgett, Kanya, Rutherford, & Mayes, 2017; Crandall, Deater-Deckard, & Riley, 2015).

Parents with executive dysfunction have more difficulty consistently applying authoritative parenting practices, such as engaging in warmth interactions, applying adequate limits and providing autonomy support, and tend to present with reactive and harsh parenting (Bridgett et al., 2017; Crandall et al., 2015; Cuevas et al., 2014; Prinzie et al., 2003, 2009). Therefore, it has been suggested that parents' executive dysfunction impacts child behavior *via* dysfunctional parenting practices (Bridgett et al., 2017).

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Child Disinhibition

During development, children transit from external regulation to self-regulation (Bernier, Carlson, & Whipple, 2010). They learn to regulate their behavior by interacting with their caregivers (Bernier et al., 2010; Morris, Silk, Steinberg, Myers, & Robinson, 2007). Behavior regulation requires the adequate development of inhibition (Barkley, 2001). Inhibition consists of (a) inhibiting the initial prepotent response, (b) interrupting an ineffective ongoing response, and (c) protecting self-directed responses from interference (Barkley, 2001). Inhibition involves creating a delay and valuing long-term consequences over short-term ones (Barkley, 2001). Poor child inhibition capacity or disinhibition is a risk factor for disruptive behavior (Schoemaker, Bunte, Espy, Dekovic, & Matthys, 2014; Sobanski et al., 2010; Munoz & Anastassiou-Hadjicharalambous, 2011).

Disruptive Behavior

Disruptive behavior is a common consequence in children with ABI and is associated with disinhibition (Chavez et al., 2015; Max et al., 1998; Rao et al., 2009). Disruptive behavior includes noncompliance, defiance, and aggressiveness (Eyberg & Pincus, 1999). It is also reported as one of the most problematic consequences of ABI by parents, teachers, and friends (Feeney, 2010; Sobanski et al., 2010). Disruptive behavior in children with ABI is a consequence of injury and parent factors (Jacobs, Harvey, & Anderson, 2011; Spencer-Smith & Anderson, 2009). Brain networks are not yet refined during childhood and are damaged by ABI mechanisms, such as elevated intracranial pressure, diffuse axonal injury, edema, and shearing strain (Jacobs et al., 2011; Spencer-Smith & Anderson, 2009).

For this reason, a younger age at injury onset has been associated with more severe damage to neural networks and its functions (Anderson, Catroppa, Haritou, Morse, & Rosenfeld, 2005; Crowe, Catroppa, Babl, Rosenfeld, & Anderson, 2012). However, the relationship between age and outcome is not linear and depends on the maturational stage during injury onset (Crowe et al., 2012; Jacobs et al., 2011; Spencer-Smith & Anderson, 2009).

Several studies have identified parent factors that enhance or diminish disruptive behavior after ABI (Anderson et al., 2012; Greenham et al., 2015; Ryan et al., 2016; Wade et al., 2016). How these factors interact remains unclear. We aim to test if potential intervention targets (parental stress, child disinhibition, and parenting practices) mediate the association of parent factors (trait-anxiety and executive dysfunction) and child disruptive behavior, and to investigate how these factors interact in a single model to influence child disruptive behavior after ABI.

It is known that children actively influence their environment and can evoke behaviors in their parents (Rashid et al., 2014; Siegler et al., 2017; Taylor et al., 2001). However, this study is mainly interested in parent factors that contribute to child disruptive behavior. This study aims to provide a clearer understanding of the interaction among parent factors and child disruptive behavior after pediatric ABI.

It was hypothesized that potential intervention targets will mediate the association of parent factors and child disruptive behavior after ABI diagnosis; child disruptive behavior reported by parents will be associated with dysfunctional parenting practices, parental stress, and child disinhibition, while child disruptive behavior reported by teachers will be directly associated with child disinhibition. Lastly, an indirect association between parent factors (trait-anxiety and executive dysfunction) and child disruptive behavior was hypothesized. This hypothetical model based on the literature is described in Figure 1.

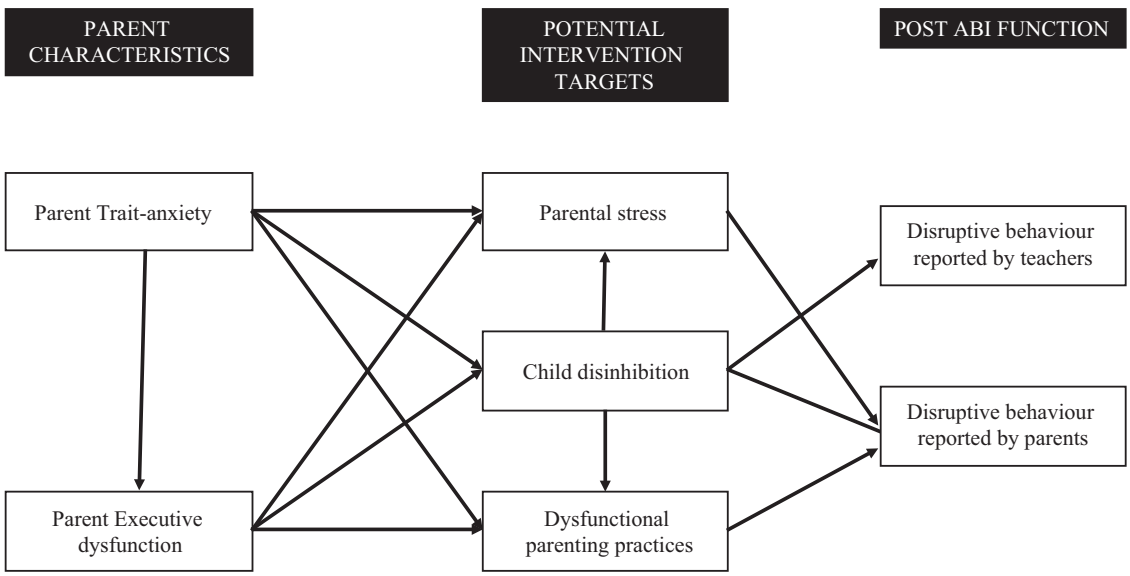

Fig. 1. Hypothetical model based on the literature.

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Methods

Participants

Parents of 77 children with a diagnosis of ABI participated in this study. Participants were recruited using posters and flyers located in hospitals, clinics, and universities in Mexico City. Families who were interested in participating contacted the researchers *via* email or phone. A face-to-face interview was arranged to provide details about the study and confirm that the participants met the inclusion criteria. Parents were asked to bring copies of the medical documentation with the description of the ABI and the imaging study when available.

Inclusion and exclusion criteria

The following inclusion criteria were required to participate in the study: (1) child aged between 6 and 12 years of age, obtained during face-to-face interviews based on medical documentation; (2) diagnosis of ABI (defined as damage to the brain diagnosed 28 days after birth) based on a medical description of the injury and/or the imaging study; (3) cause or type of ABI is documented; (4) injury occurred at least 3 months before the assessment, based on the medical description of the injury and/or the image study; (5) parents have an active and current parenting role with the child; (6) parent is over 18 years; (7) parents are able to write and read in Spanish.

The exclusion criteria were as follows: (1) parents with symptoms of psychosis or borderline personality; (2) children in ongoing medical treatment (e.g., chemotherapy, planned neurosurgery); (3) children who were currently receiving treatment to improve behavior or whose parents had been previously trained in parenting practices; (4) child or parent with a history of psychiatric diagnosis (autism, symptoms of psychosis or borderline personality; due to the high prevalence of parents with anxiety disorders, and children with anxiety disorders, attention deficit, and hyperactive disorder or learning disorder, these comorbidities and intellectual disability were not excluded); (5) child with uncontrolled seizures.

Approvals

The University of Melbourne Human Research Ethics Sub-Committee approved this study (Ethics ID: 1545487) and Mexican institutions and professionals who participated in this study assumed this opinion as their own since it protects participants' human rights. Parents were informed about the research project, and signed informed consent was obtained before the assessment session.

Setting

The assessments were conducted at Iskalti-Condesa. This clinic is close to the center of Mexico City.

Measures

Family structure

The social risk measure was used to describe family structure. This measure classifies families into intact family (two caregivers), separated parents with dual custody, and families with a single caregiver (Murray et al., 2014; Roberts et al., 2008).

The questionnaires used did not have norms for a Mexican population but were available in Spanish. Scores obtained by measuring parents' trait-anxiety, parental stress, parenting practices, and disruptive behavior are not corrected by age (not even when the standard score is obtained). Furthermore, higher scores indicate higher dysfunction in all measures used in this study. As a consequence, raw scores were used for the analysis. While raw scores are not directly interpretable, they can provide an estimate of the severity of impairment by considering high or low punctuations.

Parent's trait anxiety

The State-Trait Anxiety Inventory (STAI; Diaz-Guerrero & Spielberg, 1975) is a questionnaire that measures anxiety symptoms in adults using a Likert scale. We used the raw score of the trait subscale, which consists of 20 items for analysis. The instruction in this subscale asks one to choose the option that reflects how parents usually feel rather than how they feel at the moment. Higher scores indicate a higher level of trait-anxiety. STAI has proven a reliable and valid measure (Cronbach's alpha [α] = 0.93; Díaz-Guerrero, & Spielberg, 1975).

Parent's executive dysfunction

The Behavior Rating Inventory of Executive Function-Adult Self-report (BRIEF-A; Roth, Isquith, & Gioia, 2005) assesses executive dysfunction in daily life. It consists of 75 items scored using a Likert scale. The raw score of the Global Executive Composite was used for the analysis. Higher scores indicate greater executive dysfunction. BRIEF-A has proven a reliable and valid measure (α 0.93–0.96; Roth et al., 2005).

Parental stress

The Parent Stress Index (PSI) short form (Abidin, 2012) was used to measure parental stress, using the Total Stress raw scores. This scale consists of 36 items that reflect the level of parental stress experienced by parents and does not consider stress related to other roles and life events (Abidin, 2012). Higher scores indicate an elevated level of parental stress. The PSI has proven a reliable and valid measure (α = 0.90; Abidin, 2012).

Parenting practices

The Parenting Scale (PScale) is an index of dysfunctional parenting practices (Arnold, O'Leary, Wolff, & Acker,

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Table 1. Demographic characteristics of children and their primary caregiver

	Mean (SD*SD*)/Frequency (%)
Child age in years	9.37 (2.122) range 6–12
Age at ABI diagnosis in years	5.88 (3.26) range 0–6.5
Time since injury in years	3.6 (2.44) range 0.4–11
Hispanic	77 (100%)
Gender Malemale	46 (59.7%)
TYPE OF LESION	
Atrophy of unknown origin	2 (2.6%)
Brain tumour	23 (29.9%)
Cyst	21 (27.3%)
Infection	2 (2.6%)
TBI	18 (23.4%)
TBI + Cystcyst	5 (6.5%)
Vascular lesion	5 (6.5%)
Brain malformation	1 (1.3%)
SOCIAL RISK	
Mother is the primary caregiver	74 (96.1%)
Age of the primary caregiver in years	35.73 (6.189) range 21–48
Intact family structure	54 (70.1%)
Single parent	8 (10.4%)
Separated parents with dual custody	15 (19.5%)

ABI = acquired brain injury; TBI = Traumatic traumatic Brain brain Injuryinjury; *SD* = Standard standard deviation.

1993). PScale is a 30-item questionnaire that measures overreactivity, laxness, and verbosity, which are dysfunctional parenting practices. We used the version translated into Spanish by permission of the first author, David Arnold. The total raw score was used for the analysis. Increased scores indicate more use of dysfunctional parenting practices. This scale was previously used to study the disciplinary practices of parents of children with ABI and has proven a valid and reliable measure ($\alpha = 0.84$; Woods et al., 2014; Prinzie, Onghena, & Hellinckx, 2007).

Child disinhibition

The inhibition subscale from the BRIEF parent form (Gioia, lsquith, Guy, & Kenworthy, 2000) was used to measure child disinhibition. The inhibition subscale consists of eight items. The raw score was used for the analysis. Higher scores indicate disinhibition. The inhibition subscale has proven a reliable and valid measure ($\alpha = 0.96$; Gioia et al., 2000).

Disruptive behavior

To measure disruptive behavior, we used the intensity subscale from the Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus, 1999). ECBI was answered by the primary caregiver and measures the frequency of disruptive behavior. The Student Eyberg Sutter Behavior Inventory (SESBI; Eyberg & Pincus, 1999) was used to measure disruptive behavior reported by teachers. The teacher who spent most time at school with the child answered the questionnaire. Both inventories (ECBI and SESBI) consist of 36 items and increased scores indicate a high frequency of disruptive behavior. The ECBI (α 0.95) and SESBI (α 0.98) have proven reliable and valid measures (Eyberg & Pincus, 1999).

Statistical Analysis

Descriptive statistics of the children and their primary caregiver characteristics were analyzed using IBM SPSS and are reported in Table 1.

Mediation

A mediation is conceived when a third variable, the mediator, intervenes between two other variables (Iacobucci, 2008; Shrout & Bolger, 2002). When there are multiple mediators in one model, there can be mediator–mediator interaction as well (VanderWeele & Vansteelandt, 2014). For this reason, when a model includes more than one mediator, each mediator can be tested independently. The mediators in the final model (Figure 2) were tested independently. To test the mediation models, we followed the steps recommended by Shrout and Bolger (2002). The mediation test was carried out as follows: (Step 1) showing that the exogenous variable (X) is related the endogenous variable (Y) by testing and estimating the regression coefficient (path-c) (Shrout & Bolger, 2002).

These authors distinguish between proximal (strong empirical supported causality X-Y) and distal processes (Shrout & Bolger, 2002). For proximal processes path-c must be significant, whereas for distal processes significance in path-c is not required (Shrout & Bolger, 2002); (Step 2) showing that X is related to the mediator (M) by estimating and testing the regression coefficient (path-a); (Step 3) showing that M is related to Y, while X is constant by estimating the regression coefficient (path-b) in a multiple regression equation with Y as an outcome of X and M; (Step 4) while paths a and b are included, estimate and test the regression coefficient between X and Y (path-c´) (Shrout & Bolger, 2002).

Mediation occurs when path-c´ (Step 4) is smaller than path-c (Step 1). Complete mediation occurs when path-c´ is not significant, whereas partial mediation occurs when path-c´ is smaller than path-c and remains significant (Fairchild & McDaniel, 2017). To understand how factors interact in a more complex (and realistic) model, path analysis can be conducted (Streiner, 2005).

Path Analysis

Path analysis is an extension of multiple regression that allows examinations of relationships among variables and comparison of different models (Streiner, 2005). In path analysis, exogenous variables influence the endogenous variables (Peyrot, 1996; Streiner, 2005). For this reason, reciprocal or bidirectional relationships are not possible with

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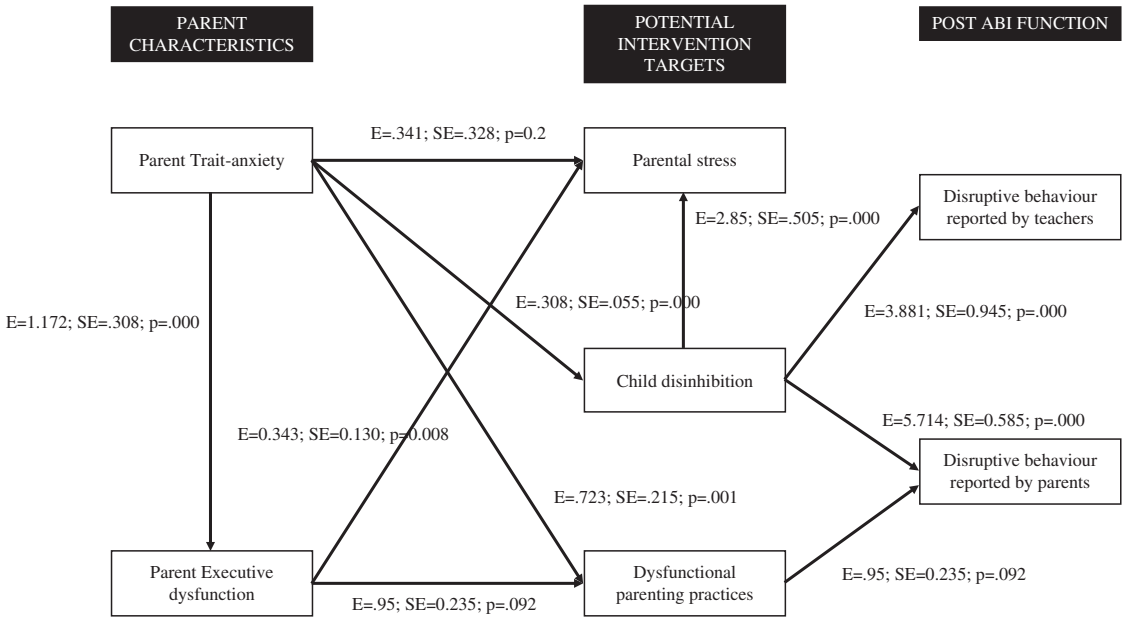

Fig. 2. Final model.

path analysis (Streiner, 2005). For example, an exogenous variable (e.g., parents' trait-anxiety) cannot receive an arrow from an endogenous variable (e.g., child disruptive behavior). Thus, the current study focuses on understanding how parent factors influenced child outcomes. Path analysis was conducted in Mplus 7.2.

The data met the assumptions for path analysis; the variables presented with a normal distribution (skewness and kurtosis within a range of ± 1.96) and was complete for all variables except for behavior reported by teachers. Eight teachers did not return the questionnaires. The analysis was conducted taking the missing values into account. A non-significant chi-square (χ^2) is considered a good fit (Schreiber, Stage, King, Amaury, & Barlow, 2006). Indicators of optimal model adjustment used were Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) in which values of $\geq .95$ are required for the acceptance of the model (Finch & West, 1997; Schreiber et al., 2006). A root mean square error of approximation (RMSEA) value of $\leq .06$ is considered an adequate model fit (Finch & West, 1997; Schreiber et al., 2006), as is a standardized root-mean-square residual (SRMR) value of $\leq .08$ (Amaya-Hernández et al., 2013; Schreiber et al., 2006).

Wald tests were used to identify paths that could be removed to improve the model fit. Path coefficients were used to test the direct effects and bootstrapped estimates were used to test all the indirect effects in the final model (Figure 2). The number of bootstrap samples for bias-corrected bootstrap confidence intervals was 1000 in all analyses. In line with previous studies (Micklewright et al., 2012), the significance of indirect effects was determined by (1) the significance of the unstandardized regression coefficients and (2) exclusion of zero between the upper and lower bounds in the confidence intervals. The single step approach can be applied when the effect on the outcome is transmitted through several mediators (Saunders & Blume, 2017). In path analysis, the single step approach consists in testing each mediator independently, before estimating the total indirect effect in a multiple mediator model (Saunders & Blume, 2017). Due to the inclusion of multiple mediators in a single model (Figure 1), both analyses were conducted in the current study. In addition, the path analysis model provides a more complete picture of the interaction among these factors in a single model, which may be relevant to consider in potential intervention programs.

RESULTS

Demographics

Table 1 shows the demographic information of the participants. The age of the children participating in this study ranged between 6 and 12 years. Most children were male (59.7%). Diagnosis of a brain tumor (29.9%), brain cyst (27.3%), and TBI (23.4%) were predominant in the sample. The severity of the TBI was determined by the treating physician using the Glasgow Coma Scale and ranged from mild (six participants) and moderate (three participants) to severe (nine participants). The mother was the primary caregiver in 96.1% of families. Most families participating in this study (70.1%) comprised two caregivers living together. Children with a diagnosis of a brain cyst presented with behavioral or neurological symptoms associated with the cyst, which affected their daily activities. Eight of the participants with a diagnosis of brain cyst underwent neurosurgery. Six participants were diagnosed with developmental disorders (one

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with a learning disorder, three with ADHD, one with ADHD and anxiety disorder, one with ADHD and learning disorder). However, only 19% of the participants had received a neuropsychological assessment before enrolling in the current study, which may have resulted in children being underdiagnosed.

Direct Effects

The analysis revealed a significant direct effect from parents' trait-anxiety to parents' executive dysfunction (B = 1.72; *SE* = .308; $p < .001$), child disinhibition (B = 0.31; *SE* = 0.06; $p < .001$) and parenting practices (B = 0.72; *SE* = 0.21; $p = .001$). A significant direct effect was also seen from parents' executive dysfunction to parental stress (B = 0.34; *SE* = 0.13; $p = .008$) and parenting practices (B = 0.18; *SE* = 0.08; $p = .036$), and from child disinhibition to parental stress (B = 2.09; *SE* = 0.51; $p < .001$), disrupted behavior reported by parents (B = 5.71; *SE* = 0.59; $p < .001$) and teachers (B = 3.88; *SE* = 0.95; $p < .001$). No significant direct effects were found between parenting practices and disruptive behavior reported by parents (B = 0.40; *SE* = 0.24; $p = .092$), or between parents' trait-anxiety and parental stress (B = 0.34; *SE* = 0.33; $p = .299$).

Mediation

Child disinhibition partially mediates the association of parents' trait-anxiety and child disruptive behavior reported by parents (Path-c: E = 2.124, *SE* = .556, $p = .000$; Path-a: E = .308, *SE* = .055, $p = .000$; Path-b: E = 6.173, *SE* = .54, $p = .000$; Path-c´: E = .301, *SE* = .479, $p = .53$) and teachers (Path-c: E = .033, *SE* = .025, $p = .174$; Path-a: E = .308, *SE* = .055, $p = .000$; Path-b: E = 3.521, *SE* = .883, $p = .000$; Path-c´: E = −0.449, *SE* = .65,4 $p = .492$). Child disinhibition partially mediates the association of parental stress and parents' trait-anxiety (Path-c: E = 1.398, *SE* = .308, $p = .000$; Path-a: E = 308, *SE* = .055, $p = .000$; Path-b: E = .308, *SE* = .055, $p = .000$; Path-c´: E = .649, *SE* = .331, $p = .050$).

Dysfunctional parenting practices partially mediate the association of disruptive behavior reported by parents and their trait-anxiety (Path-c: E = 2.124, *SE* = .556, $p = .000$; Path-a: E = .930, *SE* = .172, $p = .000$; Path-b: E = 1.212, *SE* = .337, $p = .000$; Path-c´: E = 1.407, *SE* = 0.64, $p = .028$). Parents' executive dysfunction partially mediates the association of dysfunctional parenting practices and parent trait-anxiety (Path-c: E = .903, *SE* = .172, $p = .000$; Path-a: E = 1.172, *SE* = .308, $p = .000$; Path-b: E = .340, *SE* = .068, $p = .000$; Path-c´: E = .207, *SE* = .107, $p = .053$). Parents' executive dysfunction partially mediates the association of parental stress and parents' trait-anxiety (Path-c: E = 1.398, *SE* = .308, $p = .000$; Path-a: E = 1.172, *SE* = .308, $p = .000$; Path-b: E = .674, *SE* = .114, $p = .000$; Path-c´: E = .828, *SE* = .343, $p = .016$). Parenting practices partially mediate the association of executive dysfunction and disruptive behavior reported by parents (Path-c: E = .765, *SE* = .243, $p = .000$; Path-a: E = 1.212, *SE* = .337, $p = .000$; Path-b: E = .340, *SE* = .068, $p = .000$; Path-c´: E = .340, *SE* = .068, $p = .000$).

Indirect Effects

Bootstrapped estimates revealed significant indirect effects between parents' trait-anxiety on disruptive behavior reported by teachers through child disinhibition (B = 1.19; *SE* = 0.37; $p = .002$; 95% confidence interval [CI] [0.38, 2.33]), parents' trait-anxiety on disruptive behavior reported by parents through child disinhibition (B = 1.73; *SE* = 0.34; $p < .001$; 95% CI [0.87, 2.69]), and parents' trait-anxiety on parental stress through child disinhibition (B = 0.64; *SE* = 0.20; $p = .001$; 95% CI [0.20, 1.21]). Indirect effects were not significant between parents' anxiety and child disruptive behavior reported by parents through parenting practices (B = 0.28; *SE* = 0.18; $p = .12$; 95% CI [−0.13, 0.889]), parents' trait-anxiety on parenting practices through parents' executive dysfunction (B = 0.20; *SE* = 0.11; $p = .053$; 95% CI [−0.10, 0.50]), child disruptive behavior reported by parents and parents' executive dysfunction through parenting practices (B = 0.07; *SE* = 0.05; $p = 0.19$; 95% CI [−0.05, 0.24]). Parents' trait-anxiety on parental stress through parents' executive dysfunction was significant (B = 0.40; *SE* = 0.17; $p = .015$). However, zero was included between the upper and lower bounds in the confidence intervals (95% CI [−0.03, 0.086]).

Path Analysis

Figure 2 describes the results of the path analysis model. Wald tests were applied to the hypothetical model, and, based on the results, three paths were removed: parental stress – disruptive behavior, child inhibition – dysfunctional parenting practices, and parents' executive dysfunction – child disinhibition. Ten paths remained in the model, as described in the direct effects section below. The last model, described in Figure 2, had a good model fit. The χ^2 for the path model was not significant ($\chi^2 = 0.34$). All indices obtained values of ≥.95, indicating good model adjustment (CFI = .990; TFI = .974). Lastly, the results of the RMSEA and SRMR indicate good model adjustment as well (RMSEA = .059; and SRMR = .059).

DISCUSSION

This study aimed to understand how parent factors (trait-anxiety and executive dysfunction) influence parental stress, dysfunctional parenting practices, and child disinhibition after ABI, and how these factors are associated with child disruptive behavior. A hypothetical model was tested in which some of the associations were confirmed, while others were not supported. Child disruptive behavior at home and school was directly associated with child disinhibition, while it was not associated with parental stress and indirectly associated with parents' trait-anxiety.

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Child disinhibition and dysfunctional parenting practices mediate the association of parents' trait-anxiety and child disruptive behavior. Executive dysfunction mediates the influence of parents' anxiety on dysfunctional parenting practices and parental stress. Child disinhibition was the only potential intervention target tested that remained significant in the indirect effects model. The current study provides new evidence of the underpinnings of child disruptive behavior after ABI and has relevant implications for its treatment.

The current study breaks new ground by suggesting that trait-anxiety and executive dysfunction underpin dysfunctional parenting practices commonly seen in parents of children with ABI. Parents with high trait-anxiety are more likely to unintentionally ignore positive child behavior and overreact to negative behavior (Anastopoulos, Guevremont, Shelton, & DuPaul, 1992). For this reason, children whose parents present with more trait-anxiety are likely to develop insecure attachment to their caregivers, which has been associated with disruptive behavior (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Siegler et al., 2017).

Furthermore, in line with previous studies (Bernier et al., 2010; Bridgett et al., 2011; Bridgett et al., 2017; Sandi & Richter-Levin, 2009), the current study indicates that efficient executive functions are required to implement authoritative parenting practices. Parents require attention to respond appropriately to their child's needs, require cognitive flexibility to switch responses across situational demands and working memory to temporarily store and manipulate information about parent–child interaction (Barrett & Fleming, 2011).

The previous literature describes how parents of children who suffered a life-threatening illness tend to be more directive, give excessive help, and as a consequence provide limited autonomy support (Fales, Essner, Harris, & Palermo, 2014; Power, Dahlquist, Thompson, & Warren, 2003). Parents of children with medical conditions have to monitor activities, such as playing sports, or circumstances such as taking medication, and must provide a special diet. This parental over-involvement may exacerbate the disruptive behavior (Hoehn, Foxen-Craft, Pinder, & Dahlquist, 2016; Lønfeldt, Marin, Silverman, Reinholdt-Dunne, & Esbjørn, 2017; Woods, Catroppa, Barnett, & Anderson, 2011).

Parents of children with ABI may benefit from psychological support to help them cope with the treatment process by providing them with strategies to enhance authoritative parenting practices (e.g., positive behavior supports) following ABI diagnosis. Cognitive behavioral interventions adapted for parents of children with ABI, such as acceptance and commitment therapy and positive psychotherapy, may help parents deal with the treatment process, but further evidence is required regarding these methods (Wilson, Winegardber, van Heugten, & Ownsworth, 2017).

An innovative finding of the current study indicates that the development of inhibition after ABI onset is susceptible to parental expressions of anxiety. This is in line with previous research describing that children learn from parental expressions of anxiety through daily interactions (Aktar et al., 2017); moreover, children whose parents present with dysfunctional parenting practices are at elevated risk of presenting with poor executive functions (Kok et al., 2014; Lucassen et al., 2015).

In addition, the development of inhibition relies on brain networks commonly disrupted by ABI onset (Anderson, Jacobs, & Anderson, 2008). The current results indicate that, in children with an ABI, the major contributor to child disruptive behavior seems to be their disinhibition. When studied independently, parenting practices mediated the association of disruptive behavior and parents' trait-anxiety. However, if parenting practices are investigated in combination with other variables, such as child disinhibition, its impact is lessened.

Child disinhibition was the only potential intervention target tested that remained significant in the indirect effects model. This result may explain why improving parenting skills does not always lead to a reduction of disruptive behavior in children with ABI (Chavez-Arana, Catroppa, Carra, et al., 2018). In addition, behavior reports from teachers also show an effect of child disinhibition on disruptive behavior, indicating that, even if parents present authoritative parenting practices and low levels of trait-anxiety, children require an adequate inhibition capacity to regulate their behavior.

Identifying child disinhibition as the major contributor of child disruptive behavior after ABI has relevant implications for treatment. Child disinhibition is a potential intervention target to reduced child disruptive behavior after ABI. To date, intervention programs focused on improving inhibition after ABI are lacking. Previous interventions applied directly to the child, such as biofeedback and using video games, have shown promising results in improving disinhibited behavior in other pediatric populations (O'Neil, Jamieson, & Goodwin, 2017; Schuurmans, Nijhof, Engels, & Granic, 2018); however, their effect on child inhibition after ABI requires further study.

Parental stress derives from parent interaction with the child (Abidin, 2012). To our knowledge, this is the first study in the field of pediatric ABI describing child disinhibition and parents' executive dysfunction as mediators between parental stress and parents' trait anxiety. Child disinhibition is seen in daily activities, such as interrupting conversations, constant movement, and the need for constant supervision, and increases the stress level of parents, especially if they already present with trait-anxiety and executive dysfunction. In other words, parents with trait-anxiety and executive dysfunction are more likely to be disturbed by disinhibited behaviors.

In addition, the current study adds to previous findings highlighting the active role of children in shaping their environment (Siegler et al., 2017; Taylor et al., 2001) by proposing that child disinhibition has an effect on parental stress. The results indicate that an intervention applied directly to the child in combination with an intervention applied directly to parents may be ideal in improving child behavior and reducing parental stress after ABI. The

Program for the Education and Enrichment of Relational Skills (Laugeson & Park, 2014) and Cool Kids (Rapee et al., 2006) are interventions applied to the child and to parents simultaneously and could serve as examples to develop interventions aiming to reduce disruptive behavior in children after ABI.

Limitations

The results of this study should be interpreted in light of its limitations. One limitation of the current study is that in path analysis, it is recommended to have 10 participants per parameter, whereas the final model had 7.7 participants per parameter. The small sample size may lead to type II errors. This may explain why the effect of dysfunctional parenting practices on disruptive child behavior and the effect of parent trait-anxiety on parental stress were significant in the mediation model but not in the path analysis. Furthermore, due to a relatively small sample, not all variables, for example, family structure and injury variables, could be included in the model. In addition, parents interested in participating in the study could present with different unknown characteristics from those who were not interested, and family sociodemographic variables were not considered in the model.

Another limitation is that due to the lack of standardized instruments with Hispanic and, specifically, with Mexican populations, raw scores were used for analysis. The lack of standardized instruments could impact the results, especially for the outcomes of parent executive dysfunction and child disinhibition in which standard scores are corrected by age.

Future Directions

The association between parents' trait-anxiety and child disinhibition requires further study to understand how genetics, injury, sociodemographic factors, and parents' expressions of anxiety impact the development of inhibition and behavior post-ABI. Future studies using larger samples could include more variables and provide further evidence of how child and injury factors interact. It is also essential for future studies to work on the standardization and validation in the Mexican population of the instruments used in this study.

CONCLUSION

The underpinnings of child disruptive behavior following ABI are complex. The current study provides evidence of parent anxiety and child disinhibition as major contributors of child disruptive behavior after ABI. Child disinhibition was the only potential intervention target tested that remained significant in the indirect effects model and, thus, is a prospective target to reduce child disruptive behavior after ABI. Clinicians treating children with ABI whose parents' primary concern is their child's disruptive behavior should consider parent anxiety and child disinhibition in their initial assessment.

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