

**An ecological and lifespan approach of social influences on childhood pain experiences**

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**Abstract:**

Pediatric pain is a common experience that not only impacts the child but also their social environment (e.g., parents, peers, school functioning). Several models have been formulated to gain a better understanding of the social context interwoven with pediatric pain, with the Social Communications Model the most well-known and comprehensive model. More recent model development has focused on providing an explanation of specific pathways to adaptive or maladaptive pain-related functioning in children (e.g., Interpersonal Fear-Avoidance Model, Ecological Resilience-Risk Model). The purpose of the current chapter is to provide an overview of both the Interpersonal Fear-Avoidance Model and the Ecological Resilience-Risk Model, followed by a critical evaluation of their merit in furthering our understanding of pediatric chronic pain across development and within the broader social context (e.g., peers and school environment). The chapter will conclude with directions for future research, model development and clinical practice.

**Keywords:**

Pain, child, adolescent, parental responses, pain-related fear, catastrophizing, resilience, peers, school environment, developmental perspective.

## Introduction

Understanding the social consequences of pain and its reciprocal impact upon the sufferer's pain experiences are of particular importance in the pediatric pain context as children highly depend upon adults (primarily their parents) for help and care (Palermo, Valrie, & Karlson, 2014). This reciprocal relation between child pain and parental responses is well demonstrated within the influential *Social Communication Model of Pain* (Craig, 2009). Specifically, the Social Communication Model of Pain recognizes three important steps in understanding how personal pain experience within the child impacts parental behavioral responses. The first step entails the child's internal experience of pain (e.g., stinging, burning, ... pain sensations), which is encoded in expressive pain behaviors (= second step, e.g., facial pain expressions, guarding behaviors, crying). These expressive pain behaviors act as cues for the parent(s), who will decode the child's expressive behavior in order to draw inferences about their child's pain experience and determine how to respond (= third step, e.g., parental pain estimation, parental emotional distress, parental protective behavior, parental distraction). Importantly, the model highlights that this parental behavioral response, may, in turn, have an impact upon the child's internal pain experience (step one) and pain expression (step two; Hadjistavropoulos et al., 2011). Considerable evidence has provided support for the assumptions of the Social Communication Model of Pain within the context of pediatric acute and chronic pain (Hadjistavropoulos et al., 2011; Palermo et al., 2014). For example, counter-intuitive evidence has revealed that while parents tend to automatically engage in protective behaviors such as reassurance, these behaviors have been linked to increased child pain and disability (e.g., Lisi, Campbell, Pillai Riddell, Garfield, & Greenberg, 2013). In contrast, parental engagement in distraction, humor or coping-

promoting suggestions (e.g., suggesting their child to take a deep breath) has been associated with reduced child pain intensity and disability (Uman et al., 2013; Walker, Williams, Smith, Garber, Van Slyke, & Lipani, 2006).

While the Social Communications Model is a well-known, comprehensive model of childhood pain experience, more recent model development has focused upon particular processes that may play a role in the pathway to adaptive or maladaptive pain-related functioning in children (e.g., Interpersonal Fear Avoidance Model and the Ecological Resilience-Risk Model). Underlining the importance of the social context of the pediatric pain experience, these newer models put a strong emphasis on the role of parental interpretations and responses as well as family characteristics to fully understand childhood pain.

For example, the Fear-Avoidance Model, originally developed for adults (Vlaeyen & Linton, 2000), has recently been adopted to the context of pediatric pain and introduced as the *Interpersonal Fear-Avoidance Model* (IFAM; Goubert & Simons, 2013). An important and substantial aspect of this adaptation comprised the inclusion of how parental cognitive (e.g., pain interpretation and catastrophic thinking), emotional (e.g., parental fear) and behavioral responses (e.g., parental protective behavior) and the child's catastrophic thinking, fear and avoidance behaviors influence each other in determining the child's pain-related functioning (Goubert & Simons, 2013). In a similar vein, but with a focus on protective mechanisms and resources supporting positive or effective adaptation to pediatric chronic pain, Cousins and colleagues (2015) proposed the *Ecological Resilience-Risk Model* (ERRM). The ERRM emphasizes how protective factors and mechanisms within the child's social environment (i.e., family functioning, parental behavioral responses and teacher/peer

support) can enhance the child's resiliency or effective responding when faced with the adversity of chronic pain experiences (Cousins, Kalapurakkel, Cohen, & Simons, 2015).

The purpose of the current chapter is to first provide a brief overview of both the *Interpersonal Fear-Avoidance Model* and the *Ecological Resilience-Risk Model*, followed by a critical evaluation of their merit in furthering our understanding of pediatric chronic pain across development and within the broader social context (e.g., peers and school environment). To conclude, we will provide some future directions for research, model development and clinical practice.

### **The Interpersonal Fear-Avoidance Model**

To better understand the origins and persistence of chronic pain complaints and pain-related disability in adults (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen, 2007) and children (Asmundson, Noel, Petter, & Parkerson, 2012), researchers have frequently relied on the Fear-Avoidance Model (FAM). At the core of this model is the idea that catastrophic thoughts about pain (i.e., perceiving pain as a threat, ruminating about pain, and feeling helpless in coping with pain) may set the stage for pain-related fear, which, in turn, may motivate individuals to behave in ways that allow them to avoid pain (e.g., avoiding social or school-related activities that are expected to heighten pain). Yet, evidence shows that persistent attempts to avoid pain often lead to maladaptive long-term consequences, such as disability and depression. Although the majority of work in this area has focused on adult pain (Leeuw et al., 2007; Crombez, Eccleston, Van Damme, Vlaeyen, & Karoly, 2012), recent evidence suggests that the very same processes may also be central to the development and maintenance of chronic pediatric pain and disability (Simons & Kaczynski, 2012; Simons, Smith, Kaczynski, & Basch, 2015). For instance, studies have shown that children

with high levels of catastrophizing thoughts about pain report having more difficulty performing daily activities (Crombez et al., 2003; Guite, McCue, Sherker, Sherry, & Rose, 2011). Pain catastrophizing in children has also been shown to predict increased pain and disability 6 months later (Vervoort, Eccleston, Goubert, Buysse, & Crombez 2010). Additionally, high levels of pain-related fear in children and adolescents have been associated with higher disability levels and more frequent physician visits (Simons, Sieberg, Carpino, Logan, & Berde, 2011).

Accumulating evidence shows that the wider social context in which the child is embedded influences their catastrophic thoughts about, as well as fear and avoidance of pain and that parents play a particularly important role in this regard. This work has led to the emergence of the *Interpersonal Fear-Avoidance Model (IFAM)* which highlights the impact that parents have on the development and maintenance of (chronic) pediatric pain (Goubert & Simons, 2013; Simons et al., 2015). In line with the Social Communication Model of Pain (Hadjistavropoulos et al., 2011), the IFAM assumes that pain takes place within a social context, with parents as the most influential agents. Specifically, a sender (in this case the child) who experiences pain may express this pain in different ways (e.g., through facial or full body pain displays and/or verbal messages), which may be observed and decoded by others (e.g., parents) (Goubert et al., 2005). As part of this decoding, parents will interpret these pain messages expressed by the child (e.g., how much does my child suffer), which may give rise to pain-related fears in the parent when pain is appraised as very threatening (i.e., catastrophic pain interpretation). These parental fears may motivate parents to engage in so-called protective behaviors, aimed at the reduction or avoidance of pain in their child. Parental attempts to protect their child from pain may however negatively impact child

functioning and psychosocial development (Goubert & Simons, 2013; Simons et al., 2015; Sinclair, Meredith, Strong, & Feeney, 2016). See Figure 1 for an overview.

- Insert Figure 1 about here -

Indeed, it has been shown that higher levels of parental catastrophizing about the child's pain are related to more child disability (Lynch-Jordan, Kashikar-Zuck, Szabova, & Goldschneider, 2013; Goubert et al., 2006; Logan, Simons, & Carpino, 2012; Vowles, Cohen, McCracken, & Eccleston, 2010), lower school attendance (Goubert et al., 2006) and a higher tendency to restrict child activities that may augment pain (Caes, Vervoort, Eccleston, Vandenhende, Goubert, 2011). Accumulating evidence further shows that protective parenting behaviors are positively correlated with child functional disability (Sieberg, Williams, & Simons, 2011; Claar, Simons, & Logan, 2008; Kaczynski, Claar, & Logan, 2009; Logan et al., 2012; Wilson, Lewandowski, & Palermo, 2011). Preliminary prospective evidence supports this association between parental protective behaviors and child functioning. Specifically, in a cohort of 195 children and adolescents with chronic pain who presented for a multidisciplinary evaluation, it was found that baseline parental protective behavior significantly predicted child functioning at 4-month follow-up (Chow, Otis, & Simons, 2016). Of interest and supporting the assumptions of the IFAM, research has shown that parental protective behaviors mediate the relationship between parental catastrophizing and adverse child outcomes such as school functioning (Logan et al., 2012) and disability (Sieberg et al., 2011). Parental protective behaviors may fuel child avoidance behaviors, resulting in higher levels of child disability (Welkom, Hwang, & Guite, 2013).

In addition to this direct pathway by which parents may impact child outcomes through engaging in (over)protective behaviors, the IFAM also acknowledges that parents can impact

children's psychosocial functioning in an indirect way, i.e., through observational learning processes (Goubert, Vlaeyen, Crombez, & Craig, 2011). When parents are highly fearful about the child's pain and perceive pain in a threatening way, fearful behaviors (such as fearful facial expressions) may be picked up by the child and fuel the child's fears and catastrophizing thoughts (Simons et al., 2015). Wilson, Moss, Palermo, & Fales (2014) for instance showed that parental catastrophizing was related to child functioning through its impact on children's catastrophizing thoughts. It has also been proposed that the way parents cope with their (own) pain may impact children's coping repertoire (Goubert et al., 2011). Although there is abundant research in adult pain on the impact of social modeling (see Craig, 1986; Helsen, Goubert, Peters, & Vlaeyen, 2011; Helsen, Goubert, & Vlaeyen, 2013; Helsen, Vlaeyen, & Goubert, 2015), the evidence in the context of pediatric pain is scarce (Goodman & McGrath, 2003; Thastum, Zachariae, Scheler, Bjerring, & Herlin, 1997).

A strength of the IFAM is the recognition of the bidirectionality between parent and child responses which not only impacts child outcomes but can also influence parental quality of life. For example, the chronification of the child's pain may fuel parents' catastrophizing and fearful thoughts, which may have as a consequence that parents become narrowly focused on alleviating their child's pain, and neglect other things they value in life (e.g., work performance or their social life). This may negatively impact parents' mood, and may eventually lead to depressive feelings in parents, which might, in turn, affect their child, leading to a vicious circle of catastrophizing/fear, avoidance, parental protection, depression and pain (Goubert & Simons, 2013; Simons et al., 2015). Moreover, these maladaptive parent-child interactions likely result in short term and long term alterations in brain processes in the child and parent (Simons, Goubert, Vervoort, & Borsook, 2016) that



manifest as alterations in physiology, behavior, and emotional state.

### **The Ecological Resilience-Risk Model**

The Ecological Resilience-Risk Model has recently been formulated in response to the dominant focus on maladaptive coping in the context of pediatric pain. Processes and mechanisms which optimize the quality of life in families of a child experiencing chronic pain (i.e., resilience) have been largely overlooked (Cousins et al., 2015). Nevertheless, a substantial body of research on pediatric chronic illnesses demonstrates that many family units demonstrate substantial flexibility and resiliency in the face of ongoing interference due to chronic illness. For example, in a large-scale ( $N = 10,650$ ) epidemiological study in Flemish young people (age range: 10-21 years;  $M_{age}=14.33$  years), 19.1% of young people reported experiencing high levels of pain accompanied by low levels of disability, thereby reflecting resilience despite being faced with chronic pain (Vervoort, Logan, Goubert, De Clercq, & Hublet, 2014). Furthermore, a recently conducted systematic review on family-level strengths or family resilience in the context of childhood cancer revealed that most families are resilient in various domains of functioning, such as family support, cohesion, positive communication, and adaptability. However, the available evidence is lacking in their usage of theoretical frameworks to guide the research question and approach. To facilitate further progression in this field, more research applying a family resilience framework is warranted (Van Schoors, Caes, Verhofstadt, Goubert, & Alderfer, 2015).

Resilience can be defined as “*a dynamic and multi-systemic progression that allows the individual to respond effectively when faced with risk or adversity (e.g., chronic pain)*” (Cousins et al., 2015). Importantly, the definition of resilience as well as the ERRM acknowledge that resilience originates within the individual, but can be enhanced through

factors in the individual's social environment. Similar to the development of the IFAM, the ERRM for pediatric chronic pain is adapted from an adult model, namely the adult chronic pain *Risk-Resilience Model* (Sturgeon and Zautra, 2013). While resilience and vulnerability were long considered as the opposites of a continuum, the chronic pain Risk-Resilience Model introduced the idea of resilience and vulnerability being two independent but related constructs that determine the individual's pain-related trajectory. Importantly, a distinction is made between '*resilience resources*', '*resilience mechanisms*' and '*resilience outcomes*'. Resilience resources are portrayed as stable characteristics (e.g., optimism and hope), while mechanisms are characterized as dynamic and modifiable processes (e.g., positive affect and positive relations) of a person and his/her social context. Resilience resources promote resilience mechanisms but minimize the impact of vulnerability factors and mechanisms, which in turn interfere with the impact of resilience resources. These resilience and vulnerability pathways determine the resilience outcomes, which consist of three distinct components: 1) sustained engagement in highly valued activities, 2) recovery from stressful experiences such as pain flares, and 3) personal growth or benefit-finding (Sturgeon and Zautra, 2013).

The ERRM represents an adjustment of the adult model to account for the unique situation of childhood pain experiences. Specifically, despite the dearth of research addressing the social context as a source of resilience, the resilience resources and mechanisms available in the child's social environment play a prominent role within ERRM. The resilience and vulnerability pathways are proposed to occur within the individual itself and his/her social environment (including family, peers, school environment and culture), with a bidirectional relationship between the child's individual and social pathways

determining the outcomes of the child in pain (See Figure 2; Cousins et al., 2015).

- Insert Figure 2 about here -

The main goal of the ERRM is to facilitate continued research on resilience resources, mechanisms, and outcomes in pediatric chronic pain. The authors therefore highlight that further research is warranted to test and potentially refine the proposed pathways. Nevertheless, preliminary findings provide evidence for the role of resilience resources such as optimism, mindfulness, positive peer relations, teacher support, and supportive parent and family functioning in improving outcomes (e.g., increased quality of life and pain tolerance; reduced pain intensity and school absenteeism) for adolescents with chronic pain and their family (Cousins, Cohen, & Venable, 2015; Palermo et al., 2014; Petter, Chambers, McGrath, & Dick, 2013; Vervoort et al., 2014). With respect to identifying resilience mechanisms relevant for pediatric chronic pain, various research efforts (e.g., explorative, instrument development and intervention studies) point to the beneficial impact of child acceptance of pain, child self-efficacy, and parental psychological flexibility on emotional and functional disability as well as improved school functioning (Carpino, Segal, Logan, Lebel, & Simons, 2014; Kalapurakkel, Carpino, Lebel, & Simons, 2015; Wallace, McCracken, Weiss, & Harbeck-Weber, 2015; Weiss, Hahn, Wallace, Biggs, Bruce, & Harrison, 2013).

Contrasting with the large body of research available on vulnerability factors when faced with pediatric chronic pain, substantial knowledge is lacking on various aspects of resiliency such as the role of positive affect, committed action, parent modeling of active coping and promotion of activity engagement, benefit finding, and self-regulation (Cousins et al., 2015). Yet, focusing on the role of protective factors, and how they interact with vulnerability factors in the context of pediatric chronic pain is of critical importance to optimize clinical

interventions. Specifically, protective factors and processes may be easier to influence and reinforce than vulnerability factors and therefore play a key role in clinical practice (Hilliard, Harris, & Weissberg-Benchell, 2012).

### **Critical Discussion of IFAM and ERRM**

Both the IFAM and ERRM were developed in response to the need for developmentally and contextually appropriate models that reflect a child's experience of chronic pain. While both models acknowledge that developmental changes throughout childhood can influence the child's pain experience, they only provide a limited account of how exactly the proposed pathways might differ for infants, preschoolers, children and adolescents. In addition, while both models put a strong emphasis on the role of parental responses and family functioning in understanding the child's pain experience and impact on the family, the social context in childhood is broader than parental and familial influences. Particularly, in adolescence a key developmental task is gaining independence from their parents, which goes hand in hand with increased importance of and reliance on peers (Viner & Christies, 2005). Research has shown that the experience of chronic pain during childhood has the potential to impede these developing social skills (e.g., making new friends and maintaining relationships; Forgeron, King, Stinson, McGrath, MacDonald, & Chambers, 2010). How each of these aspects can impact the child's pain experience and how they currently are or could be incorporated within the IFAM and ERRM will be discussed below.

### **Developmental Perspective**

The first examination of the FAM's application to pediatric pain demonstrated that there are developmental differences among children and adolescents (Simons & Kaczynski, 2012). Fear of pain had a stronger indirect role between catastrophizing and avoidant behaviors

among adolescents as compared to younger children with chronic pain. This suggests that targeting fear-related pain cognitions (“I walk around in constant fear of hurting”) when working with adolescents will likely yield greater gains in returning to previously avoided activities, than in younger pain patients, who are likely more responsive to a more concrete, behaviorally driven intervention.

There were also differences that emerged between younger children and adolescent patients with regard to avoidant behaviors. Adolescents reported significantly higher levels of fear-avoidance, which may be due to greater agency in choosing to avoid social or academic activities (e.g., “I cancel plans when I am in pain”), whereas younger children may have less choice in doing so (Simons & Kaczynski, 2012). This is where examining the influence of parents and even peers on this relationship is essential. It is likely that the influence of context (parents, peers) and therefore the authority for decision-making varies within childhood and thus cannot be examined as a static variable across children and adolescents. In support of this, Caes and colleagues (2014) revealed that parental engagement in protective behaviors prior to an invasive, painful medical procedure was related to more child non-verbal pain behavior following the procedure, but only for younger children (Caes, Vervoort, Devos, Verlooy, Benoit, & Goubert, 2014). Taken together, these findings highlight the differential influence of parental behaviors depending on the child’s developmental status.

The ERRM explicitly mentions the importance of an ecological framework in considering adaptation to adversity such as pain and frames the model in reference to Bronfenbrenner’s ecological systems theory (Bronfenbrenner, 1979). In particular, the ERRM points to the occurrence of resilience and vulnerability pathways within time, with mutually influencing individual, familial/social and cultural pathways. However, limited further explanation or

evidence is provided on how these pathways develop across child development. A recent study examining pain catastrophizing across development does suggest the need to examine these differences (Feinstein et al., 2016). The authors found that pain catastrophizing was a significant predictor of pain interference and mobility in adolescents and young adults with chronic pain, but not for children. This is consistent with differences that emerged when testing the adult FAM in pediatric pain (Simons & Kaczynski, 2012) and reflects recent discussions that pain catastrophizing in children may simply reflect normal worry rather than a pathological process (Eccleston, Fisher, Vervoort, & Crombez, 2012). Similarly, while not explicitly accounted for in the ERRM, it is reasonable to assume that developmental states could strengthen or weaken the link between parental and child resilience resources and mechanisms.

Taken together, our understanding of how vulnerability and resilience pathways within the child and their interactions with the social context (parents, peers) alter throughout development is limited and would benefit tremendously from more longitudinal research across the lifespan.

### **Role of Peers**

Given the importance of peers in the psychosocial development of children and adolescents, peer support has been suggested as an important resilience mechanism (Sinclair et al., 2016; Forgeron & King, 2013). Although the IFAM (Goubert & Simons, 2013) acknowledges the role of the parental cognitive-emotional and behavioral responses in explaining the development and maintenance of children's chronic pain complaints and disability, it neglects the role of other potential social agents, such as peers. The ERRM refers to the role of social support as a resilience mechanism of adaptive child functioning in the

presence of pain, but it only briefly touches on the role of peers (Cousins et al., 2015).

Despite not being included in the existing theoretical models, accumulating evidence suggests that disruptions to peer relationships, friendships, and social engagement are common and characterized by child avoidance of potentially fundamental social situations with friends and romantic interests (Forgeron et al., 2010). This is a major concern, especially for adolescents who develop and refine key social skills within the context of their relationships with peers. For instance, children and adolescents with chronic pain often have fewer friends than their healthy peers, they may miss opportunities for social leisure activities, and are at increased risk for victimization (for an overview, see Forgeron et al., 2010). Research also has shown that adolescents with chronic pain feel lonelier than their healthy peers (Forgeron et al., 2011), feel more distressed by negative interactions with friends, and report that friends are not always supportive because they lack insight in living with a daily condition such as chronic pain (Forgeron & McGrath, 2008). A qualitative study by Fleischman, Hains, & Davies (2011) showed that practitioners perceive a decline in adolescents' peer functioning over time, with adolescents often avoiding other peers. Practitioners attributed this avoidance of peers more to the pain than to social (in)competence. Furthermore, peers perceive adolescents with chronic pain as more withdrawn and less popular (Kashikar-Zuck, Lynch, Graham, Swain, Mullen, & Noll, 2007). The latter study also showed that these adolescents had fewer reciprocated friendships (Kashikar-Zuck et al., 2007).

A study by Forgeron et al. (2011) provides preliminary understanding of the potential underlying mechanisms involved in this compromised social functioning by suggesting that social information processing may be different in adolescents with chronic pain compared to

controls. It was found that adolescents with chronic pain interpreted non-supportive social situations with close friends as more distressing and expected more supportive behaviors from friends. Eccleston, Wastell, Crombez, & Jordan (2008) investigated the impact of chronic pain on social development in 110 adolescents with chronic pain. The findings showed that adolescents generally perceived themselves to be behind their peers in their psychosocial development, which could further explain the compromised social functioning in these adolescents. Of interest, strong peer relationships were associated with positive social comparisons, indicating that the presence of good peer relationships may be a resilience mechanism (Eccleston et al., 2008). This perception of being socially delayed was recently confirmed in a large cohort study of over 800 adolescents with chronic pain drawn from a community sample (Caes, Fisher, Clinch, Tobias, & Eccleston, 2015). In this large community sample of adolescents with chronic pain especially girls who experienced high levels of pain-related anxiety endorsed this feeling of being behind in their social development, thereby highlighting gender differences in how pain can impact social experiences.

Despite the fact that the majority of research focused on how pain experiences negatively impact children's engagement with peers, recently interest has been growing on how peer support can be effectively stimulated to enhance resilience and health outcomes. For example, the systematic review by Forgeron and colleagues (2010) also provided evidence for the power of positive friendships, which are related to improvements in pain intensity and social competence (Walker, Claar & Garber, 2002). Furthermore, these positive friendship relations were found to counteract negative family and peer interactions (Walker, Garber & Greene, 1994; Kaminsky, Robertson & Dewey, 2006).



Recently, research efforts have started to focus on how to incorporate these buffering aspects of strong social support in interventions. Forgeron, Chorney, Carlson, Dick, & Plante (2015) examined, in an adolescent group who had attended a 10-week structured self-management program, whether adolescents with chronic pain wanted to befriend other adolescents suffering from chronic pain. During the course of the program, 32% became friends, 52% were interested in becoming friends with another peer suffering from chronic pain, and 15% were not interested in making friends. The most often reported peer support was emotional support, in which pain was a common topic during interactions. Kohut and colleagues (2016) developed an online peer mentorship intervention, the iPeer2Peer program, to enhance self-management skills of adolescents with chronic pain. In this program, young adults (18-25 years) who learned to successfully cope with their pain act as a role model and provide reinforcement to younger peers (12-18 years). Results from a feasibility trial showed that adolescents who completed the iPeer2Peer program demonstrated significant improvement in self-management skills compared to adolescents assigned to a waiting-list control group (Kohut et al., 2016). This study is one of the first to suggest that a peer mentoring intervention may be useful to help adolescents with chronic pain develop successful pain management skills.

In sum, the available evidence suggests that peer relationships may be negatively impacted by chronic pain, and that interpersonal reactions by peers, depending on their nature, can either have adverse or beneficial effects on the child's pain experience. However, research investigating the role of peer relationships and peer support in the context of pain is still in its infancy (Forgeron & King, 2013). This might be partially due to the lack of specific assessments to assess the unique impact of childhood pain experiences on social functioning

and competency. More research is needed with regard to a) the underlying mechanisms by which pain impacts friendship relations, b) the differences with regard to the impact on female versus male friendships as well as children's versus adolescents' friendships, and c) the impact of interventions on peer relationships and friendships (Forgeron & King, 2013).

### **Role of School Environment**

The school environment is a paramount part of children's life, which not only focuses on learning and cognitive-emotional functioning, but is also a crucial environment for developing adequate social skills (e.g., developing social competency and a sense of self in a wider environment; Shui, 2001). However, similar to the lack of acknowledgment of peer influences, the IFAM does not provide predictions on how the school environment could act as either a vulnerability or buffer when faced with pediatric chronic pain. The ERRM briefly highlights the role of teacher support as a potential resilience resource that can have a positive impact on the child's competence and functioning despite chronic pain experiences (Cousins et al., 2015). However, an in-depth account of the mechanisms explaining the protective role of the school environment is lacking.

Despite limited inclusion within the available theoretical models, the pivotal role of the school environment in a child's development has widely been acknowledged across various research efforts. The majority of the research evaluating the impact of chronic pain on the child's functioning does include the impact on school functioning. This evidence reveals that the experience of pain can have a profound negative impact on various aspects of the school experience, including children's school participation, attendance, academic achievement, peer relationships and their perceived competence in these domains (Dick & Riddell, 2010; Gorodzinsky, Hainsworth & Weisman, 2011). The impact on school attendance has

traditionally been the most widely investigated indicator of school functioning, with a substantial body of evidence pointing at elevated levels of school absences in children with chronic pain. For instance, Konijnenberg et al (2005) found that about 51% of pediatric chronic pain patients missed 1-3 days of school per month (Konijnenberg, Uijterwaal, Kimpen, van der Hoeven, Buitetlaar, & de Graeff-Meeder, 2005). While pain intensity or duration were long assumed to be the main reason for school-related disability, Logan and colleagues (2008) provided an interesting new perspective by highlighting the pivotal role of psychosocial factors such as pain-related depression and anxiety, as the main drivers of school impairment (Logan, Simons, Stein, & Chastain, 2008). Furthermore, Logan and colleagues (2008) set the stage to go beyond the sole reliance of school absenteeism as an indicator of school-related impairment. Comprehensive assessment of school functioning encompassing multiple domains including academic performance and competence, has been recommended (Logan et al., 2008).

Albeit less well understood, evidence is available for the supportive, or even buffering, role teacher support can play for children with chronic pain. For instance, having a teacher who supports child autonomy and competence has found to be associated with less school absence in children with chronic pain (Vervoort et al., 2014). The strongest influential factor explaining teachers' supportive behaviors (e.g., granting relief from responsibility and implementing accommodations for the child) seems the availability of medical evidence for the pain. However, a constructive relationship between parents and teachers was found to influence the teachers' emotional responses such as their level of sympathy (Logan, Coakley & Scharff, 2007). These findings highlight the variety of support teachers can offer and the complexity of the underlying mechanisms explaining variety in teacher support. With respect

to these underlying mechanism, the results reveal that the impact of different social agents in the child's life (e.g., parents and teachers) can interact.

Taken together, it is clear that teacher responses to chronic pain experiences by their students play an important role in understanding disability, particularly school-related disability, due to pain. While we have a good grasp on the potential detrimental impact of pediatric chronic pain on the school experience, the key aspects and underlying mechanisms of a supportive child-teacher relationship are less clear. More knowledge on the ingredients and underlying processes of a positive teacher-student relation and adequate teacher support strategies will be crucial to further our understanding of this important social influence for children with chronic pain (Sinclair et al., 2016). Taking a life-span approach will be important to evaluate whether the effective aspects of a supportive teacher-student relationship and support strategies potentially differ depending on the school setting (i.e., different needs for primary, secondary and high school students?).

### **Future Challenges**

We have come a long way in our understanding of how pediatric pain impacts the child's social functioning and how the social environment can influence a child's adjustment. However, challenges remain that will need to be overcome to substantially progress this particular aspect of childhood pain experiences. Investigation into the role of parental and family characteristics continues to be underrepresented with a recent bibliometric analysis revealing a mere 8% of pediatric pain literature dedicated to the parental and family environment (Caes et al., 2016). Even more concerning is the near absence of research involving teachers (0.29% of articles; Caes et al., 2016), which might be partially explained by the lack of theoretical guidance and availability of adequate, reliable and valid

measurement tools for this particular aspect of childhood pain. While the bibliometric analyses did not specify research including peers, a similar negligence as found for teacher-involved research is to be expected. The formulation of theoretical models such as the IFAM and ERRM is of indispensable value to guide an improved understanding of the relevant factors in a child's social environment influencing adaptation to chronic pain experiences.

It is important to note the difference between the IFAM and ERRM with respect to how they facilitate research. While the IFAM represents a theoretical model with clear and testable hypotheses, the ERRM is rather a general framework of resilience applied to the context of pediatric pain. This is useful in guiding our conceptualizations, but a theoretical model on pediatric pain resilience from which testable hypotheses can be derived may be warranted to facilitate future research efforts. As proposed within the ERRM, this theoretical model would ideally incorporate both vulnerability and resilience mechanisms to be able to reflect their connections and not just being two sides of the same coin. Consideration of vulnerability and resilience factors within a single model rather than a sole focus on either vulnerability or resilience may better explain why some children function well in the face of chronic pain. This brings the question to mind as to whether this requires drawing up a new theoretical model specifying testable resiliency pathways explaining child and parent positive adaptation? Or could the ERRM stimulate an extension of the IFAM to incorporate specific resilience pathways in both child and parents as well as their interrelation with vulnerability factors? The risk associated with extending the IFAM would be to lose its current clear focus and testability of the suggested associations and pathways by creating an all-encompassing model that is too complex to evaluate. For instance, identifying different pathways of adaptation to pediatric chronic pain based on the various possible interactions between

vulnerability and resilience factors brings with it its own statistical challenges. Testing these interactions would require a person-centered rather than more typical variable-centered approach to analyses. It is likely that future studies on resilient children at different stages of development (i.e., from childhood to young adulthood) are critical to shed more light on the exact mechanisms underlying resiliency to pain and their interactions with vulnerabilities. Albeit awaiting further evidence, it is reasonable to assume that the impact of parental vulnerability and resilience pathways is particularly strong in determining younger children's health-related outcomes, but gradually lessens throughout adolescence, as peers become a stronger source of resilience throughout development.

In a similar vein, it is worthwhile to consider how to either extend existing models to account for the buffering impact of supportive friendships and teacher relations or whether development of new, context-specific models is warranted. However, the research on the role of peer and teacher support is truly still in its infancy and would likely benefit from prioritizing efforts on systematic development of valid and reliable measures. Assessments of peer and teacher responses to pediatric chronic pain as well as assessments accounting for the unique challenges children with chronic pain might face with respect to social competence, friendships, and school performance are currently lacking. The availability of such measures would not only tremendously advance exploratory and treatment-related research opportunities but could also be applied in clinical practice to provide a comprehensive assessment of the challenges and improvements within the social context for children suffering from chronic pain.

A last challenge for future model development and refinement, that has not yet been discussed within the context of this chapter, would be the inclusion of the broader family context. The potential influence of parents is prominently featured in both the ERRM and IFAM, but

the dynamic of general family functioning has not been well-articulated or studied. Broad indicators of adaptive family functioning have been identified as important and include clear communication, well-defined roles and structure, cohesion, adaptability, effective problem solving, and affect regulation (Palermo et al., 2014), but evidence for the specific mechanisms underlying their influence in pediatric chronic pain is sparse. One study published approximately a decade ago identified a subset of patients who present in a tertiary care pain clinic have moderate levels of distress and disability, but markedly low levels of family cohesion (Sharff et al., 2005). Another early study among adolescents with fibromyalgia reported higher family conflict and poor family functioning compared to healthy peers (Kashikar-Zuck et al., 2008). Most recently, among pediatric headache patients, family functioning was identified as indirectly influencing child functional disability via a child's depressive symptoms (Kaczynski, Gambhir, Caruso, & Lebel, 2016). Investigations into resilient family characteristics are largely absent from the extant literature and likely are as important in relation to child outcomes (Cousins et al., 2015). One of the key limitations of examining the relation between family characteristics and child functioning lies in inadequate measures of family functioning, which can be incredibly dynamic, particularly in response to stress. In addition, most available assessment of family functioning relies on self-report, which might be inadequate to detect the subtle dynamics of family interactions. It may be that focusing on observation of specific mechanisms that are modeled in the home, such as affect regulation, will yield more sensitive measures of the impact of family functioning than examining global measures of family functioning such as communication or cohesion.

### **Conclusion**

While several challenges remain, the IFAM and ERRM represent the most important models

currently available to understand the social context of pediatric pain experiences. Both models have stimulated further exploration and associated understanding of how child and parental multifaceted responses to pediatric pain experiences interact in determining the child's and family adaptation to chronic pain. The main limitations associated with both models is their lack of detailed explanations on how the broader social context and developmental changes influence the child's functioning as well as the dynamic relationship between child and parental responses. With this in mind, continued efforts to provide a comprehensive insight in the social influences and consequences when faced with pediatric chronic pain utilizing an ecological (i.e., including all aspects of the child's social context) and lifespan (i.e., from infancy through adolescence) approach are critical.



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