

Associations between attachment and pain: From infant to adolescent

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Abstract

Pain experience is a negative complex phenomenon influenced by several mechanisms. Attachment processes may affect the way in which individuals experience and signal pain. Hence, in the last two decades, the role of attachment quality has drawn attention in pain research and practice. However, previous reviews on this topic focused on adulthood and/or specific types of pain. We conducted a narrative review examining the association between attachment and different pain conditions from infancy to adolescence. Two independent researchers searched scientific databases for relevant papers. A total of 17 articles were included. Results highlight the following: (a) children and adolescents with chronic idiopathic pain showed low rates of attachment security compared to control groups; (b) pain conditions are consistently associated with elevated rates of at-risk pattern of attachment and information processing; and (c) the presence of unresolved trauma or loss is higher in children and adolescents who experienced pain compared to healthy controls. Despite the significance of these empirical evidences, the impact of caregiving environment and interpersonal context on pain experience in infancy and preschool age is poorly investigated compared to adulthood. Research on pain and attachment needs to be extended since the majority of the studies are limited to specific pain conditions. Future research should investigate the role of anxious attachment on procedural pain and transition from acute to chronic pain, testing new conceptual models. These findings shed light on the importance of relational factors and psychosocial vulnerabilities in pain clinical practice. An attachment-informed approach to pain will help health professionals to offer adequate support during procedures and to increase effectiveness of interventions. A developmental perspective is needed to integrate familial and relational contribution into a multimodal assessment and treatment of pain. Longitudinal studies are recommended.

Keywords

Acute pain, anesthesia/pain, attachment, chronic pain, infants, children, adolescents

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Background

Due to its clinical significance, the study of pain intensity has dominated pain research and practice, although it constitutes only a partial aspect of this multidimensional phenomenon.^{1,2} In fact, pain is a complex negative experience which is influenced by several dynamic factors related to the child's developmental context, including family, community, and culture.³

Children and adolescents experience pain from a number of different sources and reasons. Therefore, it is essential to make proper use of specific definitions in order to recognize and address different types of pain. In this regard, Varni et al.⁴ proposed a useful four-category classification: (a) pain associated with medical and dental procedures (e.g. lumbar punctures, bone marrow aspirations, surgery, injections, and extractions); (b) pain related to observable physical injuries

or traumas (e.g. burns, lacerations, and fractures); (c) pain associated with chronic diseases (e.g. arthritis, sickle cell disease, and cancer); and (d) pain not associated with a well-defined or specific chronic disease as well as an identifiable physical injury (e.g. migraine and tension headaches, and recurrent abdominal pain syndrome).

Among the different types of pain, acute pain is one of the most common adverse stimuli experienced by children and it is often associated with increased anxiety, avoidance,

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somatic symptoms, and parental distress.⁵ Acute pain experiences usually subside with physical recovery and may also lead to a chronic pain condition.⁶ By comparing data across studies, pain is defined as recurrent when frequency varies considerably from about once a month⁷ up to at least once a week.⁸ Whereas, although no consensus exists on its definition, chronic pain is typically described as a condition persisting longer than 3 months or beyond the expected healing time.^{9,10} Chronic pain in children has a significant impact on several domains of life and it can occur continuously on a recurrent basis. Moreover, idiopathic chronic pain (without apparent organic causes) is more frequent in adolescence compared to earlier stage of development. Given that previous reviews^{11,12} have exclusively focused on adulthood and/or chronic pain, in this article, we will include different types of pain. With the aim of covering a broader spectrum of pain conditions, it is well known that the main distinction between acute and chronic is common to compare the studies and communicate the results easier.

Attachment behaviors and representations

Attachment is a relevant construct in developmental psychology, offering a robust conceptual and methodological framework to the study of human interpersonal relationship across the lifespan. It is defined as the innate predisposition to form an enduring, selective, and affectionate bond with a primary caregiver who is asked to recognize, interpret, and respond to child's signals.^{13–15} Parental sensitivity and responsiveness, along with other caregiving dimensions, play a fundamental role in determining the quality of parent-child attachment.¹⁶ Concurrently, children's attachment behaviors shape parental responses, including pain signaling, enabling caregiver to offer protection and comfort.^{17,18} This complex bidirection contributes to the organization of individual self-protective strategies and the formation of attachment mental representations. Specifically, representational models of self and others¹⁹ have a crucial impact on human expectations and guide protective behaviors, particularly in dangerous and threatening circumstances as well as in the interpersonal context.²⁰ Experimental research on pattern of attachment has found a significant link between attachment security and positive developmental trajectory.^{21,22} By contrast, empirical data also support the significant association between attachment insecurity and the increased risk for psychopathology in childhood and adolescence.²¹ Nevertheless, it is widely acknowledged that attachment insecurity does not constitute an equivalent of disorder or maladaptation.²³

Ainsworth's ABC attachment classification²⁴ distinguishes three specific categories: Type A (insecure avoidant), Type B (secure), and Type C (insecure ambivalent/resistant). By extending the pioneering work of Mary Ainsworth, several authors offer new conceptual and methodological framework.^{25–29} Other authors, using self-reported

attachment measurement,³⁰ emphasized the association between attachment insecurity and emotion regulation linking avoidance with deactivation and anxiety with hyperactivation pattern.³¹ In addition, Maunder and Hunter^{32,33} confirmed the negative contribution of insecure pattern of attachment on stress and health outcomes.

Aims

According to a developmental perspective, regardless of the approach, heterogeneous age-appropriate methods for the assessment of individual differences in quality of attachment have been used in pain research. In the last decades, there is a growing interest in studying the potential link between pain subjective experiences and attachment behaviors and representations. Following this direction attachment theory could provide a meaningful framework to shed light on child's needs of protection and comfort in the context of pain. These data supported the hypothesis that quality of attachment relationship may affect the way in which individual protect themselves in the case of acute (invasive medical procedure and treatment) and chronic pain, as well as the management and recurrence of pain.

However, to date, the key findings on this topic have only been reviewed considering chronic pain in children, adolescent, and adult samples.^{11,12} Thus, a comprehensive review covering different types of pain (e.g. acute, recurrent, and chronic) through a developmental perspective (from infancy to adolescent) could provide a more extensive picture of this complex phenomenon, adding relevant information to the field. A comprehensive approach may help to clarify the contribution of attachment to the experience of acute and recurrent pain across different developmental stages. In addition, extending the focus to different types of pain starting from early infancy might generate new insights among researchers and health professionals, enriching the scientific debate. Keeping in mind the theoretical and methodological divergences, we will discuss findings from different approaches including data collected using disparate methods (e.g. self-reported and interview).

Thus, the main aims of this article are (a) to provide a brief overview on the association between attachment organization and different pain experience from infancy to adolescence using a developmental lens and (b) to determine potential critical issues or unaddressed areas of investigation in the field of attachment and pain.

Method

Due to the broad scope of this review, formal meta-analytic and systematic methods were precluded. Instead, this article is a qualitative synthesized information from the existing good-quality systematic reviews, when available, and other relevant sources of data (randomized clinical trial (RCT) or observational studies). Thus, our main aim is to summarize

the findings of the relevant, representative, and evidence-based literature retrieved from searches of computerized databases, hand searches, and authoritative texts.

Eligible criteria were as follows: (a) participants in the study age between 0 and 18 years; (b) English peer-reviewed publication; and (c) assessment of attachment in children, adolescent, or their parents in the context of pain was investigated in the study. The electronic databases PsycINFO, PubMed, Web of Science, and Cochrane Library were searched up to 6 January 2019 without year limits. The reference lists of relevant review papers were also examined to include additional studies that were not identified by the database searches.

Two authors independently searched in databases using the following key words: “attachment” and “pain” and “paediatrics” or “infant” or “child” or “children” or “adolescents.” The search terms resulted in 1602 potential sources of evidence. After removing duplicate publications, titles and abstracts were evaluated independently by the authors and articles clearly identified as not relevant were excluded. Full articles were reviewed for direct titular mention of pain and attachment style, and 17 articles were identified (see Table 1).

Bridging attachment organization and pain experiences using a developmental lens

Anxious attachment and pain in infancy and preschool age

Infancy represents a critical period of early human development in which children regulate their inner emotional states through a dyadic interaction with an adult caregiver, who is asked to adequately address his or her discomfort or positive affect. Thus, the dyadic pattern of interaction and the adult–infant mutual influence also affect child’s expression and management of pain.^{51–54} Moreover, family is responsible for the initial pain assessment and for seeking appropriate child’s evaluation and care.⁵⁵

In this scenario, several domains are connected to child attachment pattern and caregiving environment such as emotional state and expression, cognitive evaluation of threat, coping strategies, and the behavioral responses.¹¹ Indeed, in infancy, attachment behaviors embrace a wide repertoire of signals (such as cry, body postures, facial expression, and vocalization) which are usually considered as meaningful cues to assess pain in this developmental stage.⁵⁵ Specifically, insecure attachment in early childhood is connected to two opposite types of functioning: inhibitory (Type A, avoidant) versus excitatory (Type C, ambivalent).^{18,28} In general, it is essential to consider that within Types A and C, there are also specific sub-strategies associated with different developmental pathways related to pain experience, including a distinction between normative and at-risk pattern.¹⁸

Infants usually organize inhibitory strategy when caregivers predictably do not respond to their emotional distress or show incongruous and aversive responses.²⁰ Thus, when parents positively reinforce inhibition, infant downregulate his or her own arousal minimizing the display of negative affect.⁵⁶ By contrast, infants who develop excitatory strategy exaggerate and alternate the display of negative affect to increase parental predictability. In these cases, caregivers intermittently respond to infant negative states, showing ambivalent responses which do not permit the child to clearly predict parental behaviors.²⁰ Although attachment quality is not completely defined during the first year of life, it is important to consider dyadic pattern of interaction observing bodily contact, emotional synchrony, and the use of temporal contingencies in response to pain expression. Therefore, it could be useful for professional in the context of pain to obtain information concerning parental attachment (for a review of valid self-report measures, see Ravitz et al.⁵⁷) and emotional states with reference to child’s pain. As Page and Blanchette⁵² have found in their review, the impact of parent’s anxiety on child distress is highlighted by a large number of studies. A longitudinal investigation confirms the predictive effect of caregiver sensitivity in infancy on infant pain responses in the context of immunization.⁵⁷

Together with an accurate assessment of pain (for a review, see Ruskin et al.⁵⁸), observational method could orient professionals, providing new insight about the contribution of interpersonal interactions on infant’s pain experience and communication.⁵⁹ Therefore, observational procedures for the coding of adult–child interaction in infancy are strongly recommended, such as the Infant CARE-Index (ICI).⁶⁰

Type A toddler (avoidant) may also use a more complex strategy in case of severe danger, adopting compliance or caregiving (role inversion) to please their parents.²⁴ As suggested by Kozłowska,¹⁸ these children “silence the body,” showing a restricted non-verbal and verbal communication of pain at interpersonal level. Looking the developmental pathways of these children, it is essential to consider the risks connected to the long-term affective inhibition. Another risk for Type A children (avoidant) is the possibility to express emotional distress through the body since the display of physical pain could be more tolerated and better understood by the caregiver.¹⁸ Importantly, professionals often underestimate the risks associated to this type of functioning due to child’s compliance, protest and fear minimization, vigilance, and preparation to follow adults’ directions.²⁰

Whereas, in cases of higher dangers, Type C (ambivalent) could show a more intense display of anger, fear, and/or desire of comfort.⁵⁶ As in the case of Type A (avoidant), this process leads to restrained ability to properly recognize and communicate discomfort interpersonally.²⁶ Despite young children slowly acquire the ability to understand painful experiences,⁶¹ the high occurrence of painful episodes could increase learning opportunities.³⁸ Nevertheless, the alteration of regulatory system related to anxious attachment (both Types A and C)

Table 1. Study design, characteristics, and outcomes of the 17 studies included in the review.

Author	Purpose/aims	Sample characteristics	Research design	Key findings
Horton et al. ³⁴	To examine the relationship between attachment and temperament on pain-related distress during infants' 12-month immunization appointments.	N = 130 (aged 12.06–20.70 months, M = 13.74, SD = 1.34), 58 F and their mother (M = 34.70 years, SD = 5.05).	Observational: caregiver and infant behaviors were videotaped for up to 3-min pre-needle, during procedure, and up to 5-min post-needle. Modified Behavioral Pain Scale (MBPS), Strange Situation Procedure (SSP), The Infant Behavior Questionnaire-Revised (IBQ-R).	Avoidant infants exhibited significantly less baseline distress than secure infants, probably because they may have minimized distress signals pre-needle, in keeping with an avoidant strategy. High temperament fear predicted slower regulation for avoidant infants and faster regulation for secure infants. Results support that the attachment system appears to be triggered following a painful stimulus and secure infants actively use their caregivers to help them to regulate distress by initiating close physical contact with them. None of the pre-needle behaviors predicted attachment. Proximity-seeking post-needle significantly discriminated attachment categorizations.
Horton et al. ³⁵	To determine whether specific infant behaviors, particularly proximity- and contact-seeking behavior, exhibited during immunization predict attachment.	N = 130 (M = 13.74 months, SD = 1.34), 58 F and their mother (M = 34.70 years, SD = 5.05). Same sample of the precedent study.	Observational: both pre- and post-needle. Four scales of the Scoring System for Interactive Behaviors (SSIB by Ainsworth) during the SSP.	The interaction of disorganized attachment and fearful temperament was significantly associated with distress; fear predicted an increase in distress only in infants with a disorganized attachment classification. The main effects of attachment insecurity and temperament were not associated with increased infant distress.
Wolff et al. ³⁶	To examine the effects of attachment and temperament on infant distress during venipuncture (blood sample).	N = 246 (aged 13.1–17.5 months, M = 14.5, SD = 0.8), 49.2% F and their caregiver.	Observational: 1 h before, during, and after venipuncture. SSP was videotaped; Infant Behavior Questionnaire (IBQ-R); Generation R Infant Distress Scale. Caregiver: General Functioning of the Family Assessment Device, Global Severity Index of the Brief Symptom Inventory.	The interaction of disorganized attachment and fearful temperament was significantly associated with distress; fear predicted an increase in distress only in infants with a disorganized attachment classification. The main effects of attachment insecurity and temperament were not associated with increased infant distress.
Pritchett et al. ³⁷	To explore observational correlates of attachment patterns during immunization.	N = 19 parent-child pairs (probably aged 3–8 years, no other data available).	Observational: both pre- and post-needle. Manchester Child Attachment Story Task (MCAST), Mellow Parenting Observational System (MPOS). Each immunization video was coded for the presence and/or absence of both pain-reducing and pain-promoting behaviors.	Parents of securely attached children engaged in pain-reducing behaviors significantly more often than parents of insecurely attached children.
Walsh et al. ³⁸	To examine the relationship between attachment dimensions and child pain behaviors following both an everyday pain incident (e.g. bumps and scrapes) and acute pain incident (e.g. immunization)	N = 66 (M = 5.07 years, SD = 0.35), 30 F and their mother.	Observational. Separation Anxiety Test (SAT), Pain and Relationship Task (PART), Parent/Child Reunion Inventory (P/CRI), Emotion Regulation Checklist (ERC), Children's Facial Coding Scale (CFCS), Faces Pain Scale (FPS).	Secure base phenomena extend to pain situations. The ambivalence and controlling attachment dimensions were differentially related to child pain behavior.
Barone et al. ³⁹	To evaluate the extent to which behavioral problems in children with headache were associated with maternal stress and how the child's perception of security moderates this association.	N = 71 (aged 7–12 years, M = 9.8, SD = 1.3), 38 F and their mother vs N = 71 (control) and their mother.	Observational: clinical group vs healthy controls. Child Behavior Checklist (CBCL), Parenting Stress Index (PSI/SF), Security Scale.	In children with headache, the perception of attachment security decreased the strength of the association between maternal stress and externalizing behavioral problems.

(Continued)

Table 1. (Continued)

Author	Purpose/aims	Sample characteristics	Research design	Key findings
Williams et al. ⁴⁰	(a) To compare children and adolescents with migraine without aura and healthy control group on perceived attachment security and anxiety and (b) to test whether child's perceived security of attachment to mother and father mediated the association between migraine and anxiety. To investigate the role of attachment style on headache severity and psychological symptoms in children/adolescent migraineurs and association between attachment style, migraine severity, and psychological symptoms.	N = 100 (M = 10.64 years, SD = 2.85), 52 F vs N = 100 (control).	Observational: case-control study. Psychiatric Scales for Children and Adolescents–anxiety (SAFA-A), Security Scale.	Attachment mediates the association between pediatric headache disorders and anxiety. This model also suggested that there are differences between the roles played by perceived maternal and paternal attachment security.
Tarantino et al. ⁴¹	To explore the role of maternal attachment style and alexithymia on (a) child's headache severity (intensity and frequency) and (b) child's attachment style and psychological profile (anxiety, depression, and somatization).	N = 90 (aged 8–18 years, M = 12.2, SD = 2.6), 54 F	Observational. SAT + SAFA	Ambivalent attachment style may be a common vulnerability factor that impacts pain severity, anxiety, depression, and somatization symptoms in young migraineurs.
Tarantino et al. ⁴²	To assess the prevalent attachment style in school-aged children affected by migraine without aura and (b) to test its putative relationship and correlation with the main characteristics of migraine attacks.	N = 84 (aged 8–18 years, M = 11.8, SD = 2.4), 45 F and their mother.	Observational. SAT, SAFA battery, maternal alexithymia (TAS-20), Attachment Style Questionnaire (ASQ).	No relationship was found between maternal alexithymia levels, attachment style, and children's migraine features (severity and frequency). Maternal alexithymia shows a relationship with child insecure attachment style, while attachment does not. There are significant correlations between maternal alexithymia and anxiety symptoms. Higher prevalence among MoA children of the avoidant attachment style (Type A) and significantly lower rates of secure attachment style (Type B) compared with the control group.
Esposito et al. ⁴³	To investigate the relationships among psychological problems, attachment characteristics, and the unexplained chest pain (UCP) in a group of adolescents.	N = 219 (aged 6–11 years, M = 8.96, SD = 2.14), 116 F vs N = 381 healthy controls.	Observational: clinical group vs healthy controls. SAT, Visual Analogue Scale for pain (VAS), daily headache diaries.	No significant association between total attachment levels and UCP was found. Adolescents with UCP have high levels of emotional and behavioral problems.
Bolat et al. ⁴⁴	To test the proposition that conversion reactions are the motor-sensory components of two distinct human emotional (one inhibitory, one excitatory) responses to threat in a sample of children experiencing different somatoform pain disorder.	N = 73 (aged 12–18 years, M = 14.15, SD = 1.8), 49 F and their mother vs N = 71 healthy group. N = 28 (aged 3.75–17.66 years, M = 10.6 years), 17 F.	Observational. Age-appropriate assessment of attachment, (PAA, SAA, AA) including observational procedure, semi-projective interview, and semi-structured interview.	Type A and Type C self-protective were associated to overwhelming threat. The behavioral and somatosensory components of these emotional responses can be activated automatically, and individuals can present with unwanted and medically unexplained pain or neurological symptoms.

(Continued)

Table 1. (Continued)

Author	Purpose/aims	Sample characteristics	Research design	Key findings
Kozłowska et al. ⁴⁶	To examine patterns of emotion processing in children and adolescents with high rate of comorbidity between conversion symptoms and pain and to determine whether those patterns are related to their specific sensorimotor (conversion) symptoms.	N = 76 (aged 6–18 years, M = 12.83, SD = 2.6), 53 F vs N = 76 control.	Observational: clinical group vs healthy controls. School-aged Assessment of Attachment (SAA), Transition to Adulthood Attachment Interview (TAAI).	Unlike controls, who were able to balance temporal and affective information, children with conversion disorders (medically unexplained pain, depression, anxiety, mixed anxiety and depression, and dissociative symptoms) used one of the two strategies: (a) extreme psychological inhibition or (b) psychological coercion preoccupation.
Kozłowska and Khan ⁴⁷	To describe an individual intervention—one component of a multimodal treatment program—whose aim is to help children find skills to manage their chronic, medically unexplained pain.	N = 17 (aged 6–15 years), 9 F.	Single case series. Individual intervention, including examples of specific techniques.	Two key factors were identified that contribute to the subjective pain experienced: the presence of other negative body states that are subsumed under the label of pain and a clinical history of cumulative family stress.
Tremblay and Sullivan ⁴⁸	To examine the relations between attachment styles and pain severity/depression in adolescents with different subtypes of pain (severity and frequency).	N = 382 (aged 12–17 years, M = 14.43, SD = 1.34), 223 F.	Observational. Pain Catastrophizing Scale for Adolescents (PCS-Ado), STAI, CDI, Pain Experience Interview (PEI).	Anxiety and the helplessness dimension of pain catastrophizing mediated the relations between secure, preoccupied, and fearful attachment styles and pain severity. Moreover, anxiety and the rumination dimension of pain catastrophizing mediated the relation between secure, preoccupied, and fearful attachment styles and depression.
Ratnamohan and Kozłowska ⁴⁹	To explore patterns of attachment in children and adolescents with chronic functional pain.	N = 48 (aged 9–17 years, M = 13.43, SD = 2.08), 32 F + N = 48 (control).	Observational: clinical group vs healthy controls. Structured attachment interviews. Patterns of attachment were identified using the DYM.	Children and adolescents with chronic functional pain were classified into at-risk patterns of attachment and had higher rates of unresolved loss and trauma.
Faedda et al. ⁵⁰	(a) To compare attachment type between children and adolescents with migraine without aura (MoA) and healthy controls and (b) to assess whether attachment system or the exposure to trauma affect significantly the clinical manifestations of migraine.	N = 101 (aged 8–15 years, M = 10.84), 55.4% F vs N = 101 healthy controls.	Observational: clinical group + healthy controls. Headache Questionnaire, Children's Impact of Event Scale, SAT.	Correlation between migraine, insecure attachment, and exposure to the trauma was found. Insecure attachment would amplify both the perception of the traumatic event experienced throughout life and the evolution of migraine.

undermines this potential learning process. This mechanism decreases the opportunity to receive a sensitive response from the caregiver (explanations and labeling) by which children recognize and describe their own pain experience.^{13,62}

Furthermore, children's beliefs about self-efficacy and control over pain may partially determine their coping efforts and long-term adjustment,⁶³ which can be adversely affected by high risk attachment strategies. In fact, poor emotional awareness in early childhood might increase the likelihood of using more maladaptive coping⁶⁴ and unbalanced physiological regulation.^{30,65}

In the field of acute pain in pediatric population, much attention has been paid to procedural pain. From early infancy, needle-related procedures (e.g. heel prick, vaccine injections, venipunctures, and venous cannulation) are a common source of pain and distress.^{66,67} Diagnostic and monitoring procedures are the most feared and painful events in this developmental stage.⁶⁸ Horton et al.³⁴ studied susceptibility to acute pain using the Strange Situation Procedure (SSP) showing that avoidant infants exhibit lower distress than secure infants before routine immunization, with temperamental fear moderating this association. The same research group also highlighted positive correlation between proximity-seeking behaviors post-needle and in the context of SSP in children with secure attachment. By contrast, negative associations were found in case of avoidant and disorganized attached infants.³⁵ Consistently, higher venipuncture distress was also found in disorganized children in a population-based study using the SSP.³⁶ Moreover, despite results on the impact of parental presence during child's procedure are mixed, a recent study focused on toddlerhood³⁷ revealed that pain-reducing behaviors are more common in parents of securely attached children, suggesting the potential role of attachment in clarifying caregiving contribution in the context of acute pain. In addition, there are other attachment-related factors that influence child's pain response during pain procedures.⁶⁹ For example, parent's emotional availability,⁷⁰ coping and assessment of children's pain,⁶³ as well as the ability to provide adequate explanations focused on both positive and negative aspects of the pain experience may help in diminishing children's distress level.⁷¹⁻⁷³ Moreover, the use of a limited language of Type A and inability to talk about feelings of Type C could mislead professionals representing a conspicuous challenge.

Attachment and pain in school age and adolescence

Although extra-familial contexts have a crucial impact from school age (e.g. peers and teachers), family still play a key part in the adolescent daily life, remaining a reference point for psychological comfort and identity formation. Several studies suggested that dysfunctional family relationships are associated with greater pain and disability.^{74,75} In particular, attachment insecurity represents a risk factor for several pain

experiences in school age and adolescence, especially in conditions where emotional distress could trigger pain, such as headache, abdominal,^{48,76} and unexplained chest pain.⁴⁴ A study on school-age children with headache pointed out that perception of attachment security moderates the association between maternal stress and externalizing behavioral problems.³⁹ However, no differences in terms of attachment security rates were found between clinical and control groups. A possible explanation of this result is the limited significance of self-reported measure (SS; Security Scale)⁷⁷ in measuring implicit mental representations related to child's attachment experiences with the caregiver. Nevertheless, a recent study using the SS showed lower level of perceived attachment security in children and adolescent with migraine compared to the control group.⁴⁰ In particular, a complex interaction within familial variables was found: (a) children anxiety was mediated by maternal attachment and (b) attachment insecurity with father adversely affected child's perception of security with mothers. This result suggests the prominent impact of paternal role on family of adolescent with migraine, confirming the need to consider family system as a whole. An investigation of attachment quality in school-age children found high rates of Type A pattern using the Separation Anxiety Test (SAT),^{78,79} a semi-projective interview.⁴³ Tarantino et al.⁴¹ also assessed the security of attachment using SAT in adolescent with migraine, revealing a strong association between anxious ambivalent attachment, severity of pain (frequency of attack), and several psychological symptoms, including somatization. In addition, the role of maternal alexithymia was investigated in a similar sample with mothers of ambivalent attached adolescent showing higher score compared to their avoidant counterpart.⁴²

Interestingly, Laird et al.⁸⁰ also proved the negative predictive role of anxious attachment in children with functional abdominal pain. This study, based on the Attachment-Diathesis Model of Chronic Pain in adolescents and young adults,¹² showed that insecure attachment was associated with poor physical and mental health through its effect on cognitive appraisals and coping strategies. Similarly, as confirmed by preliminary findings, discrepancies between physiological activation and reported reactivity to stressors are significantly associated with adverse health outcomes in school-age children and adolescents.⁸¹

Moreover, Kozłowska and Williams⁴⁵ found that 86% of children and adolescents with conversion and somatoform disorders, including functional pain syndromes, exhibit pattern of information processing related to inhibitory and/or excitatory self-protective strategies. Both anxious attachment developmental pathways (Types A and C) seem to contribute to adolescent and young adult conversion pathophysiology.⁴⁶

In this developmental stage, it is also useful to analyze the mechanisms through which the transition from acute to chronic may occur. Previous studies underline that parental pain management behaviors (e.g. protectiveness and solicitousness) and psychological responses (e.g. parental distress) significantly

interact with child/adolescent psychological responses such as catastrophizing, acceptance, anxiety sensitivity, and escape/avoidance behaviors.^{82,83} Empirical findings have also documented higher level of anger and dysfunctional problem solving in adolescents with insecure attachment characterized by deactivating/hyperactivating strategies.⁶⁴ Hence, adolescents with chronic pain and insecure attachment showed dysfunctional coping, greater psychological symptoms, and pain severity.^{54,80}

In the field of pediatric chronic pain, professionals should put more emphasis on patient's and parents' experience-based perspective considering the dynamic interplay within the dyad.⁸⁴ Indeed, relational factors may have negative consequences on children's recurrent/chronic pain and disability.⁸⁵ Despite research on school age and adolescent is still limited, adult literature has largely demonstrated the detrimental role of insecure attachment for the development of chronic pain condition.⁸⁶ Kozłowska and Williams⁴⁵ tested a conceptual model for the assessment and treatment of chronic pain focused on family system, providing encouraging data on management of pain in child and adolescent. Notably, the implementation of a multimodal and developmental intervention for medically unexplained chronic pain has shown positive outcomes not only in the family but also at school level.⁴⁷

Furthermore, studies focused on pain experience in children and adolescents underlined higher rates of unresolved trauma or loss in these clinical groups compared to the normative sample.^{45,49} In particular, the majority of the unresolved trauma was related to family environment (parental illness, separation, or conflict) rather than child's direct experience.⁴⁵ Familial aspects connected to traumatic experiences play a key role for child's adjustment to chronic pain and symptoms maintenance.^{49,50} At interpersonal level, peer relationship can likewise represent a protective or risk factor for children who experienced acute or chronic pain. Retrospective studies showed that higher ratings of pain in adults are associated with a history of bullying during childhood,^{87–89} suggesting the potential traumatic impact of negative experiences with peer. Given the inability to elaborate information related to this specific event, these children have an increased risk to activate inappropriate protective responses and regulatory pattern. The study of chronic pain and post-traumatic stress disorder (PTSD) comorbidity in pediatric population is often undervalued and need to be addressed using a well-validated multimodal approach.^{90,91} Importantly, unresolved traumas also encompass single or multiple experiences of unrelieved acute or chronic pain. Negative consequences of unrelieved pain can be permanent and may have a strong impact on individual's memories and information processing, especially in case of painful procedures or interventions. During medical procedures, individuals have often fewer available resources to accurately give meaning to their own experience and elaborate properly these adverse stimuli.⁹² Subjective memories of pain are multidimensional and include several aspects—somatosensory (e.g. pain intensity), affective (e.g. fear and unpleasantness), and contextual

(e.g. people, time, and place)⁹³ which are strongly associated with the quality of attachment representations. Indeed, previous studies have documented that memories of painful events in infancy and childhood are associated with long-term changes of pain perception and other related behaviors.^{72,94} Thus, early negative learning experiences related to pain procedures may lead to medical nonadherence and other psychiatric comorbidities. As Pao and Bosk⁹⁵ highlighted, memories of painful procedures may generate (a) anticipatory fear and anxiety before subsequent procedures and (b) anxiety disorders such as specific fear of blood or needle phobia. Fear and/or anxiety are commonly focused on specific objects or experiences, and it may also be extended to the perceptions of self-worth and identity formation.⁹⁶ For instance, especially for children who frequently undergo painful procedures such as bone marrow aspirations and lumbar punctures for the treatment of cancer or other serious immune deficiencies, the memory of a painful procedure may affect pain and psychological distress associated with future procedures.⁹⁵ Moreover, parental state anxiety has been associated with higher levels of pain, anxiety, and distress in children undergoing anesthesia induction before surgery and also in later development.⁹⁷ Therefore, to adequately process and organize these memories related to pain experience, it is essential to consider the effectiveness of management of pain as a top priority,⁷² taking into account possible disruption of nurturing attachment relationship (family and peers) and adverse childhood experiences.

Discussion and conclusion

Linking the contribution of attachment could represent an additional source of information to understand child's history of development and psychophysiological functioning with reference to pain (e.g. emotion regulation and coping). With respect to our first aim, we found that from infancy, caregiving and relational environment may constitute a vulnerable or protective factors for children pain experience, adjustment, and maintenance. In general, children who experienced acute, recurrent, and chronic pain showed at-risk attachment pattern and information processing, lower level of security, and higher rates of unresolved traumatic events compared to healthy control group. Attachment system appears to be triggered by painful stimulus in toddlerhood (immunization or venipuncture), with literature suggesting a potential interaction between attachment and fearful temperament.^{34,36} When child age increases, the focus shifts dramatically on chronic pain, especially on primary headaches, whereas few studies on recurrent pain are available.^{38,48} Among the relevant factors that may contribute to the maintenance of the chronic pain condition, insecure attachment seems to play a prominent role, intensifying the pain experience or hindering effective rehabilitation.¹¹ Importantly, trauma is a critical issue that should be better addressed by health professional in the field of acute and chronic pain. Hypo- or hyperactivation associated with at-risk attachment

and unresolved trauma may lead to maladaptive physiological, psychological, and behavioral responses in the context of acute, recurrent, and chronic pain.

According to our secondary aim, we identified specific areas or research related to attachment and pain that needs to be extended. First, there are a limited number of studies on attachment and pain in infancy and early childhood compared to later developmental stage. Furthermore, studies in infancy are mainly focused on immunization pain^{34,35,37} or venipuncture.³⁶ Second, literature linking attachment and functional pain conditions is scarce (e.g. abdominal and musculoskeletal pain) compared to other types of pain.

In summary, starting from infancy, distinguishing between inhibitory, excitatory pattern will help health professionals to offer adequate support during procedures and to increase effectiveness of interventions. Observational procedures from infant to preschool age and narrative from middle childhood to adolescence are suggested for an appropriate assessment of attachment, information processing, and unresolved loss or trauma.⁹⁸ In addition, promoting education on pain conditions at school level may reduce bullying fostering supportive peer relationships.

Limitations and directions for future research

It is essential to also point out the limitations of this review. The qualitative approach of this article is limited and does not provide quantitative outcomes concerning the association between attachment and several pain conditions. Thus, this methodological approach does not permit a specific reproduction of data or answer to a quantitative research question.

Despite these limitations, there are sufficient empirical evidences on the association between attachment, trauma, and pain across development and it would be useful to reconsider the existing good practices for pain management, proposed by well-recognized expert practitioners (see Supplement Material).

Future research on pain in childhood should consider the role of parenting and attachment, testing their potential moderation or mediator on child's outcomes. New conceptual model that considers the role of attachment organization on procedural pain and transition from acute to chronic pain should be proposed and tested. Moreover, due to the higher number of retrospective or cross-sectional studies, longitudinal investigations are needed. Finally, according to the studies included in this review, we recommend the implementation of a developmentally attachment-informed approach for the assessment and treatment of pain.

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Supplemental material

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