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What Mechanisms do Children and Adolescents with Chronic Pain Use to Manage their Friendships? A Review of the Literature

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ABSTRACT

This study review the available literature about friendships of children and adolescents with chronic pain, focusing on the mechanisms they use to face challenges in their relationships and the theories studies use to address this topic. We conducted a search in PubMed, PsycINFO, and WOS from inception to August 2017. We included peer-reviewed primary studies with a specific subgroup analysis of friendships in children and adolescents (6-18 years old) with the following conditions: lower limb pain, neck and shoulder pain, back pain, abdominal pain, headache and migraines, fibromyalgia, and complex regional pain syndrome. Twenty empirical articles were selected. From these studies, 18 mechanisms and 6 theories were identified. Studies show a high variability in the methodologies employed, as well as in the way they define friendships experience. Finally, very few of the studies selected are theory-based.

¿Qué mecanismos utilizan los niños y adolescentes que padecen dolor crónico para gestionar sus amistades? Revisión de la literatura científica

RESUMEN

Este estudio revisa las publicaciones científicas disponibles sobre las amistades de niños y adolescentes que padecen dolor crónico centrándose en los mecanismos que utilizan para afrontar los desafíos que sus relaciones les plantean y las teorías utilizadas por los estudios para abordar este tema. Levamos a cabo una búsqueda en PubMed, PsycINFO y WOS desde los inicios hasta agosto de 2017. Incluimos estudios primarios revisados por pares con un subgrupo de análisis específico de las amistades en niños y adolescentes (entre 6 y 18 años), con las siguientes condiciones: dolor en las extremidades inferiores, dolor de cuello y hombros, dolor de espalda, dolor abdominal, dolor de cabeza y migrañas, fibromialgia y síndrome de dolor regional complejo. Se seleccionaron 20 artículos empíricos, a partir de los cuales se detectaron 18 mecanismos y 6 teorías. Los estudios muestran gran variabilidad en la metodología utilizada, así como en el modo de definir la experiencia de las amistades. Por último, muy pocos de los estudios elegidos están basados en la teoría.

Between 11 and 38% of children and adolescents experience recurrent or chronic pain, depending on the pain problem studied (King et al., 2011). These conditions affect children and adolescents' quality of life (Huguet & Miró, 2008) and other domains of their lives, such as sleep habits and school or social functioning (Palermo, 2000; Petersen, Hagglof, & Bergstrom, 2009; Roth-Isigkeit, Thyen, Stöven, Schwarzenberger, & Schmucker, 2005). The negative effects include school absences due to pain (Konijnenberger et al., 2005; Roth-Isigkeit et al., 2005) and reductions in their participation in extracurricular activities (including sports, getting together with friends, and other social activities) (Konijnenberger et al., 2005; Langeveld, Koot, & Passchier, 1997). These children and adolescents have a deterioration in their friendships (Fales & Forgeron, 2014; Forgeron et al., 2010;

Kashikar-Zuck et al., 2007; Stinson et al., 2014) (have fewer friends, experience social isolation, and are more likely to be rejected and chosen less frequently as best friends). In front of this situation, they have to face peer and close friend relationship challenges (Forgeron, et al., 2010; Greco, Freeman, & Dufton, 2007) such as: feeling of being different from others, stigmatized (Meldrum, Tsao, & Zeltzer, 2009), or bullied (Metsähonkala, Sillanpää, & Tuominen, 1998), having to face disbelief from others (Carter, Lambrenos, & Thursfield, 2002; Fleischman, Hains, & Davies, 2011; Forgeron, Evans, McGrath, Stevens, & Finley, 2013; Forgeron & McGrath, 2008; Meldrum et al., 2009), and perceiving others' behaviors as non-supportive (Forgeron et al., 2013; Forgeron et al., 2011; Meldrum et al., 2009; Merlijn, et al., 2003). Children and adolescents with chronic pain have to face these

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friendships challenges through the use of different mechanisms. Following Cousins (Cousins, Kalapurakkel, Cohern, & Simmons, 2015), we use the term “mechanisms” to refer to the cognitions, affects, and behaviors displayed by children and adolescents in their friendships. Each mechanism can promote social isolation or involvement and might represent a risk or resilience factor, respectively, according to the resilience-risk model in pediatric pain proposed by the same author. Involvement in positive peer and friend relationships have been found to be associated with functional ability and might represent a resilience factor system to help them manage pain (Cousins et al, 2015; Fleischman et al., 2011; Sinclair, Meredith, Strong, & Feeney, 2016; Stinson et al., 2014). On the contrary, when adolescents are not involved socially, the lack of this support is a source of stress (Donovan, Mehringer, & Zeltzer, 2013; Fleischman et al., 2011; Kashikar-Zuck et al., 2007).

Social functioning has been identified as essential for health and quality of life (Hadjistavropoulos et al., 2011). In this vein, friendships are significant persons in adolescents' social networks and important sources of influence on health and wellbeing (La Greca, Bearman, & Moore, 2002). However, the available literature does not provide an identification and summary of the mechanisms that enhance and hinder peer and friend relationships in children and adolescents with chronic pain. Further investigation in the field of supportive friendships and the mechanisms involved to promote them will help to develop and test innovative approaches to chronic pain prevention and treatment (Fales & Forgeron, 2014; Yeung, Arewasikporn, & Zautra, 2012).

There are several theories that explain the nature of social relationships (including peer and friends) and how these occurs. The Social Learning theory (Bandura, 1977) and the Operant Learning theory (Skinner, 1953) explain reinforcement and modelling processes involved in social development. Two other theories that might also explain social behaviors and have been applied to the field of pain are Lazarus' theory (Lazarus, 1966), that explains how individuals cope to stressful situations, and the Fear-Avoidance Model (FAM) (Vlaeyen & Linton, 2000) that explains the avoidance behavior based on fear. Recently, the Social Communication Model of Pain (SCP) (Craig, 2009; Craig, 2015) has been applied to the pediatric chronic pain (Forgeron & King, 2013) arguing that the expression of pain by children and adolescents may affect the way others (peers and friends) interpret (decode) and respond to their pain (act). At the same time, peers and friends' responses to children or adolescents' pain expression may positively or negatively affect their pain experience. In other words, as mentioned above, their relationships could be a source of support or stress, and the result of this cycle of interactions may influence social interactions of children and adolescents with chronic pain (interpersonal factors) and the pain intensity perceived (intrapersonal factors) (Forgeron & King, 2013).

Therefore, this article aims to: first, describe the study characteristics of the current evidence available in relation to peer and friend relationships in children and adolescents with chronic pain; second, identify (where possible) the mechanisms they use to manage these relationships and whether they tend to be related to involvement or isolation; and third, explore the psychological theories studies use to explain social behavior.

Method

Literature Search and Data Sources

We conducted an electronic search in each of the following three databases: PsycINFO, PubMed, and Web of Science from their origins until 15 August 2017. PsycINFO and PubMed are two of the main databases used in the fields of Psychology and Medicine (Baker Pistrang, & Elliott, 2015). Additionally, we considered to conduct a

search with the multidisciplinary academic database Web of Science, as friendships topic might be achieved by other disciplines.

We used the following combinations of terms: “pain” and “child* / infant / adolescent* / juvenile / teen* / young* / school age” and “peer* / friend* / interpersonal / social*” in the title and/or abstract of the articles. Some of these terms have been previously used in searches from salient reviews in the field of pediatric chronic illnesses, including pain (Forgeron et al., 2010; Kohut, Stinson, Giosa, Luca, & van Wyk, 2014; Lewandoski, Palermo, Stinson, Handley, & Chambers, 2010; Tong, Jones, Craig, & Grewal, 2012). The full search strategy is described in detail in Table S1, S2 and S3.

Study Selection

Two of the authors independently reviewed the titles and abstracts of all the citations. They were blind to authors and institutions, and all the articles that met the criteria were full-text reviewed. In addition, reviewers examined reference lists of all the articles included in order to identify any additional articles that might have been missed by the search strategy. Articles were selected using the following inclusion criteria:

(C1) Primary sources (e.g., not meta-analysis, reviews, letters, or commentaries)

(C2) Published in English or Spanish.

(C3) Targeted school-aged children (6-12 years old) and/or adolescents (13-18 years old).

(C4) Children or adolescents presenting one of the following chronic pain conditions: lower limb pain, neck and shoulder pain, back pain, abdominal pain, headache and migraines, fibromyalgia, and complex regional pain syndrome. Therefore, we did not include pain due to medical conditions, medical procedures, or disease.

(C5) Included a specific subgroup analysis or specific attention to peer and friend relationships.

Any disagreement was discussed until agreement was reached. Inter-rater agreement for full-text screening was 93% (Cohen, 1968).

Quality Assessment

The heterogeneity of study designs in the articles selected for the review (descriptive, case-control, and cohort) and the nature of studies (no intervention studies or randomized controlled trials were found) made it not possible to follow the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009) and assess the quality of the methodology with a unique structured quality scale. To overcome this problem and do a proper assessment according to the nature of studies, we followed the solution adopted by Jarde (Jarde, Losilla, & Vives, 2012) by using a different checklist for each study design. Therefore, the methodological quality of quantitative studies was reviewed using Downs and Black's (1998) checklist, and for qualitative studies, the Critical Appraisal Skills Programme (2013) was used. The quality appraisal for each study is described in Table S4 and S5. No study was rejected due to low methodological quality.

Data Extraction

Predefined data were extracted by one of the authors: authors and year of publication, participants and chronic pain condition, study design, primary focus of the study, and instruments and measures used to assess peer and friend relationship characteristics (Table 1). Detailed data about the mechanisms involved in peer and friend relationships were extracted (Table 2), as well as whether a theory was used to explain these relationships. A second reviewer checked the information selected through each process, and a consensus was reached if there were any discrepancies.

During the data extraction process, we contacted one author in order to obtain the full-text version of one of the articles selected. However, when some data were missing (i.e., mean age or standard deviation, or specific items of questionnaires used), we did not attempt to contact authors for further information or search for extra data.

After reviewing the articles, and to fulfill the second objective involving the identification of mechanisms, we followed this four-step process: first, to detect the behaviors, cognitions, affects, or even strategies that are cited or described in some way in the study; second, to check whether strategies were attributed to the child or adolescent in pain or to his peers and friends; third, to collect and organize data in different categories according to their similarity; and fourth and finally, to assign a label to each category in order to define and differentiate them as mechanisms.

Results

An electronic database search yielded 7,185 citations, and 18 additional studies were selected from the reference lists examined and hand searched. After accounting for duplicates, titles and abstracts of the 4,839 remaining articles were screened for relevance, and non-primary sources (C1) were excluded. Next, we applied the aforementioned criteria (C2-C5). Consequently, 20 studies (Bandell-Hoekstra et al., 2002; Caes, Fisher, Clinch, Tobias, & Eccleston, 2015; Carter et al., 2002; Castarlenas et al., 2015; Donovan et al., 2013; Eccleston, Wastell, Crombez, & Jordan, 2008; Forgeron et al., 2013; Forgeron et al., 2011; Forgeron & McGrath, 2008; Greco et al., 2007; Guite, Logan, Sherry, & Rose, 2007; Karwautz et al., 1999; Kashikar-Zuck et al., 2007; Konijnenberg et al., 2005; Langeveld et al., 1997; Larsson & Sund, 2007; Meldrum et al., 2009; Metsähonkala et al., 1998; Vannatta et al., 2008; van Tilburg et al., 2015) met inclusion criteria and were included in the review (Figure 1).

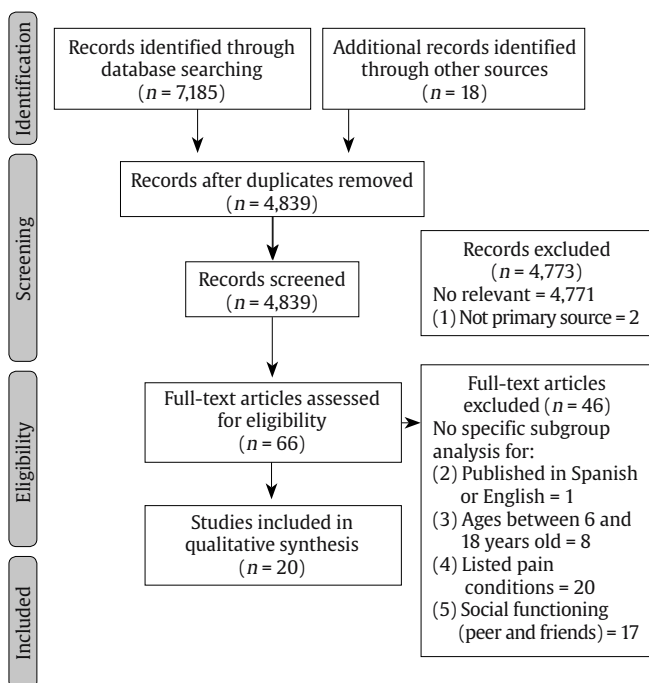


Figure 1. PRISMA [39] Flow Diagram.

The two articles excluded for not being primary sources (C1) were fully reviewed to scan their reference lists because one of them was an outstanding systematic review, and the other was a commentary related to the aims of our study. All the 8 studies

excluded by C3 have adult participants, and none was excluded for including children less than 6 years old. Those studies that did not specify the chronic pain condition and researched chronic pain in general (Fleischman et al., 2011; Forgeron, MacLaaren, Chorney, Carlson, Dick, & Plante, 2015; Merlijn et al., 2003) were excluded by C4. Using the same criteria, studies that clearly included pain due to disease or pain conditions not listed (such as the gynaecologic pain, that was mixed with other pain condition listed) were also excluded (Simons, Logan, Chastain, & Stein, 2010). Specific subgroup analysis or specific attention to peer and friend relationships (C5) was sometimes embedded into the broad term of social functioning, yet in studies selected we assured that friends and peers were cited and considered in some way.

According to objectives, results are presented in three sections: study characteristics, mechanisms, and psychological theories identified.

Study Characteristics

Table 1 describes and summarizes the characteristics of the studies reviewed.

- a) Samples. Participants recruited were from 6 to 18 years old. Participants in 11 of the studies (Caes et al., 2005; Carter et al., 2002; Donovan et al., 2013; Forgeron et al., 2013; Forgeron et al., 2011; Greco et al., 2007; Kashikar-Zuck et al., 2007; Langeveld et al., 1997; Larsson & Sund, 2007) were between 12 and 18 years old. Six other studies included children under 10 years old. More specifically, one study (Metsähonkala et al., 1998) included children between 8 and 9 years old, another two studies included a separate description or analysis for two age ranges – elementary and middle school grades (Vannatta et al., 2008), and elementary and high school (Bandell-Hoekstra et al., 2002) –, and the other four studies (Castarlenas et al., 2015; Karwautz et al., 1999; Konijnenberg et al., 2005; van Tilburg et al., 2015) involved both children and adolescents, but without providing separate analyses for this broad age range. Regarding gender, most of the samples with chronic pain contained mainly females, except four of the studies (Castarlenas et al., 2015; Karwautz et al., 1999; Metsähonkala et al., 1998; Vannatta et al., 2008). One study (Carter et al., 2002) did not provide information about the gender conditions of their samples.

Chronic pain conditions addressed most in studies were: abdominal pain (Bandell-Hoekstra et al., 2002; Caes et al., 2015; Carter et al., 2002; Castarlenas et al., 2015; Eccleston et al., 2008; Forgeron et al., 2013; Forgeron et al., 2011; Greco et al., 2007; Larsson & Sund, 2007; Konijnenberg et al., 2005; van Tilburg et al., 2015), headache or migraines (Caes et al., 2015; Carter et al., 2002; Castarlenas et al., 2015; Donovan et al., 2013; Eccleston et al., 2008; Guite et al., 2007; Konijnenberg et al., 2005; Langeveld et al., 1997; Larsson & Sund, 2007; Meldrum et al., 2009; Metsähonkala et al., 1998; Vannatta et al., 2008), back pain (Caes et al., 2015; Carter et al., 2002; Eccleston et al., 2008; Forgeron et al., 2011; Forgeron & McGrath, 2008; Larsson & Sund, 2007), limb pain (Caes et al., 2015; Castarlenas et al., 2015; Forgeron & McGrath, 2008; Larsson & Sund, 2007), and musculoskeletal pain (Forgeron et al., 2013; Guite et al., 2007; Konijnenberg et al., 2005).

Samples sizes ranged from 5 to 2360. Some of the studies included additional sources of information besides children and adolescents, such as clinicians (Donovan et al., 2013), caregivers (Donovan et al., 2013; Guite et al., 2007), and teachers (Greco et al., 2007; Kashikar-Zuck et al., 2007; Vannatta et al., 2008). Nine of the 20 studies (Forgeron et al., 2013; Forgeron et al., 2011; Greco et al., 2007; Karwautz et al., 1999; Kashikar-Zuck et al., 2007; Konijnenberg et al., 2005; Metsähonkala et al., 1998; Vannatta et al., 2008) included a comparison group of children and/or adolescents without chronic pain.

Table 1. Reviewed Studies (continued)

Authors	Participants	Pain Condition	Study		Instruments and Measures (which provide peer and friendships information) ¹
	(number, sex, age group, recruitment)		Design	Primary Focus	
1. Bandell-Hoekstra et al., 2002	2815 children with CP	CP:	CS	Quality of life and pain coping strategies in relation to headache severity.	- Social interaction with peers subscale of Quality of Life Headache in Youth questionnaire.
	F = 1527 M = 1288 9-17 years (mean = 12.6, SD= 2) School	Headache	Q		- Pain Coping Questionnaire to assess pain coping (Reid, Gilbert, & McGrath, 1998).
2. Caes, Fisher, Clinch, Tobias, & Eccleston, 2015	844 adolescents with RP	RP:	CSC	Associations between pain-related anxiety, disability and judgements of social impairment.	- Self-Perception of Development subscale of the Bath Adolescent Pain Questionnaire to assess social impairment.
	F = 553 M = 291 17 years (mean = 17.78, SD= 0.42) Community	Back/Spine, Calf/Ankle/Foot, Knee, Shoulder, Abdomen, Buttock, Hip, Arm/Hand, Head, Neck, Torso/Sternum.	Q		
3. Carter, Lambrenos, & Thursfield, 2002	5 adolescents with CP	CP:	CSD	Impact of CP on the young people's life.	- Pain workshop (Participant Inquiry Paradigm; Heron & Reason, 1997). Themes: Exploration of the effects that pain has on their relationships with friends share their thoughts and dreams for the future.
	F = -	Abdominal pain	QL		
	M = - 13-19 years Clinical	Headaches Bone pain Back pain			
4. Castarlenas et al., 2015	56 adolescents with CP	CP (Vignette)	CSD	Expectations about their peers and teachers reactions to classmates with CP.	- Inventory of Peer and Teacher Responses to the Classmate's Pain Experience. Vignettes: 4 different characters: 1 boy with CP and 1 without, 1 girl with CP and 1 without).
	155 adolescents without CP		Q		
		Adolescents with CP (informants):			Items: How they thought their peers and teachers would respond when the child described in the vignette was feeling pain or occasionally pain (in the case of non-CP vignette).
	F = 45% de 211	Head, Face and Mouth;			

Table 1. Reviewed Studies (continued)

Authors	Participants	Pain Condition	Study	Primary Focus	Instruments and Measures
	(number, sex, age group, recruitment)		Design		(which provide peer and friendships information) ¹
5. Donovan, Mehringer, & Zeltzer, 2013	M = 56% de 211 8-15 years (mean = 11.01, SD = 1.77) School	Abdominal region; Lower Limbs.			
	12 adolescents with CP F = 8 M = 4 12-17 years (mean = 14) Community 12 caregivers 12 clinicians	CP: Migraine	CSD QL	Impact of migraines on social functioning.	- Semi-structured interviews (Grounded Theory; Corbin & Strauss, 2008). Themes: Adolescents' need to be alone. People do not understand
6. Eccleston, Wastell, Crombez, & Jordan, 2008	110 children and adolescents with CP	CP:	CSD	Adolescents self-judgements of their development vs their peers.	- Social functioning subscale of the Bath Adolescent Pain Questionnaire. Items: "I go out and meet friends".
	F = 80 M = 30 11-18 years (mean = 15.1, SD = 1.9) Clinical	CRPS RAP Low Back Pain Headache Multiple site idiopathic pain	Q		- Self-Perception of Development subscale of the Bath Adolescent Pain Questionnaire. Items: "My ability to fit in with friends, my ability to go on dates with boyfriends/girlfriends". - Peer Relationships subscale of Child and Adolescent Social and Adaptive Functioning Scale. Items: "I go out to places with my friends".
7. Forgeron & King, 2013	8 adolescents with CP	CP:	CSD	Adolescents with CP challenges with regard to their friendships.	- Individual conversational interviews (Interpretative Phenomenological; Smith & Osborn, 2003). Themes: Rethinking the self with pain and their friendships. Meaning of friendships, information about their friends, supportiveness, and preferences about being treatment or treat friends.
	F = 7	Widespread	QL		

Table 1. Reviewed Studies (continued)

Authors	Participants	Pain Condition	Study	Primary Focus	Instruments and Measures
	(number, sex, age group, recruitment)		Design		(which provide peer and friendships information) ¹
8. Forgeron et al., 2011	M = 1 14-18 years Clinical 8 adolescents without CP	Headaches Musculoskeletal pain			
	F = 7 M = 1 14-18 years Community				
	45 adolescents with CP	CP:	CC	Supportive and nonsupportive behavior interpretation of friendships from adolescents with CP compared to healthy peers.	- Narrative vignettes (Social Information Processing).
	F = 41	Multiple pain sites	Q		Vignettes: Social situations (1 adolescents with CP and 1 or more close friends), 3 supportive intention, 3 non-supportive intention, 6 ambiguous intention. Same sex interactions for female and male participants.
	M = 4	Headaches			Items: Rate supportive vs nonsupportive behaviors and provide the rationale for the ratings. List one alternative behavior the healthy friend could have displayed and the one if the participant were the healthy vignette character. Finally, how distressed, angry or upset they would be if they were the character with CP and if they were the healthy character.
	13-18 years (mean = 15.4, SD = 1.8)	Limb, Back or Torso pain Abdominal pain			-The Social Anxiety Scale for Adolescents (La Greca & López, 1998). Domains: Fear of negative evaluation by others, social avoidance, social avoidance and distress.
	Clinical 62 adolescents without CP F = 44 M = 18 13-18 years (mean = 14.96, SD = 1.68) Community				

Table 1. Reviewed Studies (continued)

Authors	Participants (number, sex, age group, recruitment)	Pain Condition	Study Design	Primary Focus	Instruments and Measures (which provide peer and friendships information) ¹
9. Forgeron & McGrath, 2008	6 adolescents with CP F = 5 M = 1 12 - 18 years Clinical	CP: Pelvic area, Neck, Back, Hands. Feet, Left Knee and Stomach.	CSD QL	To explore the self-identified needs of adolescents living with chronic pain.	- Focus group interview (Fundamental Qualitative Approach; Sandelowski, 2000). Themes: Struggling to be normal. Relating to peers and society interferes with being normal. Management strategies. Relating to friends.
10. Greco, Freeman, & Dufton, 2007	60 adolescents with CP F = 41 M = 19 10-16 years (mean = 12.22, SD = 1.19) School 60 adolescents without CP F = 41 M = 19 10 - 16 years (mean = 12.3, SD = 1.35) School Teachers	RAP	CC Q	Frequency of the experience of overt and/or relational victimization of children with frequent abdominal pain.	- Children's Social Experiences Questionnaire. - Peer Report. Items: To identify classmates who are the targets of overt victimization "Gets beat up, is picked on by bullies" and relational victimization "Is left out, has lies and rumours told about him/her". - Social Skills Rating Scale. - Teachers Report. Items on the Social Skills Scale measure cooperation, assertion, and self-control in peer and classroom settings (no examples provided).
11. Guite, Logan, Sherry, & Rose, 2007	115 adolescents with CP F = 96 M = 19	CP: Chronic musculoskeletal pain	CSD	Self-perception competence in adolescents with musculoskeletal pain syndromes focus on their academic competence.	- Social acceptance and Close friendship subscales of Self-Perception Profile for Adolescents. Items: "Some teenagers find it hard to make friends, but for other teenagers it's pretty easy".

Table 1. Reviewed Studies (continued)

Authors	Participants	Pain Condition	Study	Primary Focus	Instruments and Measures
	(number, sex, age group, recruitment)		Design		(which provide peer and friendships information) ¹
	13-8 years (mean= 15.6 SD= 1.4) Clinical Parents		Q		
12. Karwautz et al., 1999	245 children and adolescents with CP	CP:	CC	Relevance of psychosocial factors in idiopathic headache.	- Study-specific questionnaire - Mothers Report.
	F = 121	Migraine	Q		Items: "Does your child have one (or two) best friend(s)? Does your child have any other friend(s)? (If yes, how many (number)".
	M = 124	Tensional-type Headache			
	4-19 years Migraine: (mean = 10.7, SD = 3.2) Tensional-type Headache: (mean = 11.55, SD = 3.2) Clinical 96 children and adolescents without CP F = 45 M = 51 4-19 years (mean = 10.4, SD = 4.7) Clinical				
13. Kshikar-Zuck et al., 2007	55 adolescents with CP	CP:	CC	Assessment of the peer relationships of adolescents with CP.	- Revised Class Play-Teachers, peers and adolescents Reports.
	F = 52	JPFS	Q		Dimensions of Social Reputation: Popularity/ leadership "Someone who everybody likes", Prosocial "Someone who is polite", aggressive/disruptive "Someone who is too bossy", and sensitive/isolated "Someone who is often sad".
	M = 3				- Three Best Friends - Peers and adolescents Reports.
	12-18 years (mean = 15.04) Clinical				Indicator of Social Acceptance and Mutual Friendships. Items: Choose the 3 peers in their class whom they thought of as a best friends.
	55 adolescents without CP F = 52 M = 3				- Like Rating Scale - Peers and adolescents Reports. Indicator of Popularity.

Table 1. Reviewed Studies (continued)

Authors	Participants	Pain Condition	Study	Primary Focus	Instruments and Measures
	(number, sex, age group, recruitment)		Design		(which provide peer and friendships information) ¹
	12- 8 years School Peers Teachers 149 children and adolescents with CP			Description and quantification of the impairment of children with CP.	- Role/Social limitations due to physical problems subscale of Child Health Questionnaire - Child Report.
14. Konijnenberg et al., 2005	F = 109 M = 40 8-18 years (mean = 11.8, SD = 2.6) Clinical	CP: Abdominal Headache Musculoskeletal Others	CSD Q		
15. Langeveld, Koot, & Passchier, 1997	64 adolescents with CP	CP:	L	Relation between changes in headache and the experience of quality of life.	Social interaction with peers subscale of Quality of Life Headache in Youth questionnaire to assess quality of life.
	F = 42 M = 22 12-18 years (mean = 14.4, SD = 1.5) School	Headache and migraine	Q		
16. Larsson & Sund, 2007	2360 adolescents with CP	CP:	LD	Relation of emotional/behavioral problems and social factors with pain.	- Number of friends ("0-1" or "2 or more" categories).
	F = 1192 M = 1168	Headache Stomach	Q		- Leisure time activities (including contact with peers) assessed with school absence (together) due to disease.
	12-15 years T1: (mean = 13.7, SD = 0.58) T2: (mean = 14.9, SD = 0.59) School	Back and Limb pain			
17. Meldrum, Tsao, & Zeltzer, 2009	53 children and adolescents with CP	CP:	LD	The impact of CP or RP on children within the context of their own lives and experiences.	- In-depth semi-structured interviews (Grounded Theory; Denzin & Lincoln, 2000).
	F = 36	Headache (migraine, myofascial, vascular, tension or other)	QL		Themes: A sense of isolation and difference from peers and classmates. Pain as an obstacle to personal activities and goals. Fears about how pain will affect the future.
	M = 17 10-17/18 years (mean = 14.23) Clinical	Functional neuro visceral pain disorder. Myofascial pain CRPS Fibromyalgia			

Table 1. Reviewed Studies (continued)

	Participants		Study		Instruments and Measures	
Authors	(number, sex, age group, recruitment)	Pain Condition	Design	Primary Focus	(which provide peer and friendships information) ¹	
18. Metsähonkala, Sillanpää, M., & Tuominen, 1998	1072 children with CP	CP:	PC	Occurrence of migraine and non migrainous headache and factors associated.	- Postal questionnaire - Children and Parents Reports.	
	F = 527	Headache	Q		Themes: Relationships with other children, such as "Does your child get along with other children?"	
	M = 545	Migraine				
	8-9 years					
	Community					
	2246 children without CP					
	F = 1140					
M = 1106						
	8-9 years					
	Community					
19. Vannatta et al., 2008	69 children and adolescents with CP	Migraine	CC	Friendships and social behavior of school-aged children with migraine.	- Best Friends Nomination - Adolescents and Peers Reports.	
	F = 31		Q		Indicator of Acceptance/ Popularity and Friendships or Mutual recognized dyadic relationships.	
	M = 38				Items: "Nominate the 3 best friends from a list of classmates peers in their class".	
	8-14 years				- Peer Acceptance Ratings - Adolescents and peers Reports.	
	Elementary grades				Items: "How much they like each classmate".	
	(mean = 9.92, SD = 1.01)					
	Middle school grades				- Revised Class Play - Adolescents, peers and teachers Reports.	
	(mean = 11.97, SD = 0.87)				Dimensions of Social Reputation: Leadership/ popularity, prosocial, aggressive/disruptive and sensitive/isolated.	
					Three additional items (added by the authors): "Someone who is sick a lot, misses a lot of school, or is tired a lot".	
	Clinical					
	69 children and adolescents without CP					
	F = 31					
	M = 38					
8-14 years						
School						
69 Teachers						

Table 1. Reviewed Studies (continued)

Authors	Participants	Pain Condition	Study		Instruments and Measures
	(number, sex, age group, recruitment)		Design	Primary Focus	(which provide peer and friendships information) ¹
20. van Tilburg et al., 2015	200 children and adolescents with CP	CP:	CSD	Examine and compare the relation of Gastrointestinal disorders symptom severity and child coping with Gastrointestinal disorders symptom to psychosocial outcomes in both patients with Inflammatory Bowel Disease and patients with Abdominal Pain.	- Pain Response Inventory
	F = 145	Abdominal pain of functional origin.	Q		Items: Assessing active and passive coping subscales. Self-Isolation (such as "Try to be alone") or Seeking Social Support (such as "Talk to someone who will understand how you feel").
	M = 55				
	8 - 13 years (mean = 11.20, SD = 2.6)				
	Clinical				

Note. CP = chronic pain; RP = recurrent pain; CRPS = complex regional pain syndrome; RAP = recurrent abdominal pain; JPFS = juvenile primary fibromyalgia syndrome; CSC = cross-sectional cohort; PC = prospective cohort; CSD = cross sectional descriptive; CC = case-control; LD = longitudinal descriptive; Q = quantitative; QL = qualitative.

¹Only specified the information (themes, example items or domains) provided by the authors (not further information related was searched).

Children and adolescents were recruited from clinical services in the majority of the studies, but in some cases, they were also recruited from the community (Caes et al., 2015; Donovan et al., 2013; Metsähonkala et al., 1998) or school (Bandell-Hoekstra et al., 2002; Castarlenas et al., 2015; Greco et al., 2007; Langeveld, Koot, Loonen, Hazebroek-Kampscheur, Passchier, 1996; Larsson & Sund, 2007).

b) Topics assessed. Only six studies (Castarlenas et al., 2015; Forgeron et al., 2013; Forgeron et al., 2011; Greco et al., 2007; Kashikar-Zuck et al., 2007; Vannatta et al., 2008) had a primary focus on peer and friend relationships. The rest analysed the impact of pain on life (Bandell-Hoekstra et al., 2002; Carter et al., 2002; Konijnenberger et al., 2005; Langeveld et al., 1996; Meldrum et al., 2009) and on social functioning (Caes et al., 2015; Donovan et al., 2013), social development (Eccleston et al., 2008), self-identified needs (Forgeron & McGrath, 2008), self-perceived competence in the academic setting (Guite et al., 2007), and psychosocial factors (Karwautz et al., 1999; Larsson & Sund, 2007; Metsähonkala et al., 1998; van Tilburg et al., 2015). In relation to the peer and friend aspects assessed, there was a marked variability in the content (number of friends, social acceptance or popularity, social interaction with peers, reinforcement of pain behavior, etc.).

c) Methodologies and instruments. The methodological approaches were quantitative and qualitative, with the former (quantitative) being the one most widely used in the studies selected. See Table 1 for further information about the study designs of the quantitative studies and theoretical frameworks used in the qualitative ones.

Considering the use of standardized instruments, only a few studies used the same instruments: Bath Adolescent Pain Questionnaire (BAPQ) (Eccleston et al., 2005) to assess self-perception development (Caes et al., 2015; Eccleston et al., 2008), Revised Class Play (RCP)

(Masten, Morison, & Pellegrini, 1985) in combination with Three Best Friends (TBF)/Best Friends Nomination (BFN) (Bukowski & Hoza, 1989) to describe patterns of social behavior and reciprocated friendships (Kashikar-Zuck et al., 2007; Vannatta et al., 2008) and the Quality of Life Headache in Youth questionnaire (QLH-Y) (Langeveld et al., 1996) to assess social interaction with peers (Bandell-Hoekstra et al., 2002; Langeveld et al., 1996). In addition, three studies used specific pain instruments (Caes et al., 2015; Castarlenas et al., 2015; Eccleston et al., 2008), and one of them used instruments oriented toward health and illness in a broad sense (Konijnenberg et al., 2005). The rest of the instruments were related to the social area (classmate's pain experience (Castarlenas et al., 2015), peer relationships (Bandell-Hoekstra et al., 2002; Langeveld et al., 1996; Price, Spence, Sheffield, & Donovan, 2002), perceived social support-friend (Prociano & Heller, 1983), social acceptance (Asher, Singleton, Tinsley, & Hymel, 1979; Harter, 1988; Vorst, 1990), social experiences (Crick & Bigbee, 1998; social skills (Gresham & Elliot, 1990), role and social limitation due to physical problems (Landgraf, Abetz, & Ware, 1996), illness behavior (Walker & Zeman, 1992), and pain response (Walker, Smith, Garber, & van Slyke, 1997). In parallel, ten studies used their own techniques designed for the study (focus group, workshop, qualitative and in depth interviews, or paper-and-pencil/internet surveys) (Carter et al., 2002; Donovan et al., 2013; Forgeron et al., 2013; Forgeron & McGrath, 2008; Karwautz et al., 1999; Larsson & Sund, 2007; Meldrum et al., 2009; Metsähonkala et al., 1998).

Mechanisms

Once we identified the mechanisms, following the process described above (methods section), we classified them in two main categories called isolation or involvement mechanisms, depending

Table 2. Mechanisms Involved in Peers and Friendships

	Child/adolescent in pain		Peers/friends	
	Mechanism	Studies	Mechanism	Studies
I S O L A T I O N	Emotional and failure-focused avoidance		Lack of empathy	
	Avoidance of the social situations caused by emotion or fear of public failure, rejection, or judgment.	2, 3, 6, 7, 8, 9, 11, 17, 20	Lack of awareness of being in pain or of skills to react to others' pain	5, 7, 8, 9, 17
	Interpretation of others' behavior as non supportive	7, 8, 17	Disbelief	3, 7, 9, 17
	Fear of rejection or judgment by others		Incredulity or scepticism	
	No disclosure		Judgments	7, 11
	Avoiding talking about pain and the related disability	7, 17	Others' attributions about their absences, severity symptoms, pain causes, or relief from responsibilities.	
	Catastrophizing			
	Tendency to magnify the seriousness of symptoms while feeling helpless to change symptoms and worrying about them.	1, 2, 20	Looking for alternative friends	7
	Behavioral disengagement	20	Quit the friendship	
	Giving up certain behaviors to try to feel better		Rewarding pain behaviors	4
I N V O L V E M E N T	Rethinking friendships		Being solicitous at first, but producing distancing in the long term.	
	Redefining the role and importance of existing friends	7		
	Disclosure, communicative and assertive skills	1, 7, 8, 9, 11, 20	Not rewarding pain behaviors	4, 8
	Talking properly about their needs related to their condition and the associated disability.		Not reinforcing dependence, which they find embarrassing.	
	Hiding pain	7, 8, 9, 17		
	Denying or minimizing pain to avoid stigmatization or unhelpful responses.			
	Maintaining activities and friendships	6, 7		
	Continuing with day-to-day life in spite of the pain			
	Rethinking social self	3, 7, 17		
	Redefining their own identity, capabilities, and disabilities			
	Looking for alternative activities/friends	7		
	Looking for other options that best fit the current situation			
	Rethinking friendships	7		
	Redefining the role and importance of existing friends			

on their consequences: a tendency to isolate a child or adolescent in pain from his/her peers or friends, or the opposite, a tendency to involve these children with their peers or friends.

Table 2 presents a detailed list and description of the mechanisms involved in peer and friend relationships.

As mentioned above, the mechanisms arose mainly from qualitative data, whereas only two mechanisms were based on quantitative data: catastrophizing and rewarding pain behaviors (Bandell-Hoekstra et al., 2002; Caes et al., 2015; Castarlenas et al., 2015; van Tilburg et al., 2015). The majority of the mechanisms were captured from the experiences of children or adolescents with chronic pain with their peers or friends. Two mechanisms, Looking for alternative friends and Rewarding pain behaviours (both from peers/friends' perspective), were exclusively taken from studies that examined the impact of the chronic pain on friendships, including healthy adolescents' point of view (Castarlenas et al., 2015; Forgeron et al., 2013). We identify the mechanisms described in 13 articles. The other six studies (Karwautz et al., 1999; Kashikar-Zuck et al., 2007; Konijnenberg et al., 2005; Langeveld et al., 1996; Larsson & Sund, 2007; Metsähonkala et al., 1998; Vannatta et al., 2008) provided complementary information about social functioning.

Psychological Theories

In relation to our third objective, from all the studies selected, we identified 3 of the 5 theories cited in the introduction section to describe and explain the relationships between being in pain and

friendships. Additionally, three other theories were identified. And only three of the studies were clearly theory-based, with a theory guiding the study (Bandell-Hoekstra et al., 2002; Caes et al., 2015; Forgeron et al., 2011).

The Social Learning theory (Bandura, 1977) was cited in one study (Guite et al., 2007) as a general reference in the background section, and it was related to withdrawal from regular activities or social contact. Due to their activity restriction, children and adolescents in pain had fewer opportunities to develop social skills and salient behavioral models to learn and imitate; therefore, they would show delayed social development. As variables, the authors analyzed functional disability and self-perceived competence (including social acceptance), and the latter was an important aspect to understand the relationship between pain and functional disability, as the theory postulates.

Lazarus' (1966) Theory about coping with stress appeared in two articles (Bandell-Hoekstra et al., 2002; Forgeron & McGrath, 2008). One of the studies (Bandell-Hoekstra et al., 2002) describes the pain coping strategies (such as seeking social support, internalizing and externalizing behaviours and so on) to manage stressful situations (pain) and analyzes them in terms of pain severity. Authors based their study in this theory and concluded that pain coping strategies have an important impact on pain severity. The other article (Forgeron & McGrath, 2008) discusses whether adolescents who are not interested in seeking peer support could appraise sharing their pain as somehow shameful, and thus feel incompetent in their ability to

discuss their pain with others and consequently do not use this pain coping strategy (and lose the opportunity to use social support as a resource to cope with stress). The study only assessed a few variables related to the theory (such as perceived social support, social anxiety, self-perception, coping, and disability). Direct relationships among these variables remain unclear, and authors explicitly cited the theory only in Discussion sections (Forgeron & McGrath, 2008).

The FAM (Vlaeyen & Linton, 2000) was used as the basis for one study (Caes et al., 2015) that tested some of the variables in this model. Authors showed that high pain-related anxiety is associated with greater disability in adolescents (in general), and with a self-perception of greater impairment in social functioning particularly in girls. Therefore, authors concluded that social functioning should be explored as an integral part of a Fear Avoidance Model.

Although it was not previewed according to previous literature, we identified three other theories that might also be used to explain friendships. These are the Theory of Interdependence (Kelley & Thibaut, 1978) and the Theory of Equity (Walster, Walster, & Berscheid, 1978), both based on a cost-benefit ratio, and the Social Information Processing (SIP) (Crick & Dodge, 1994) model to interpret social situations.

The Theory of Interdependence (Kelley & Thibaut, 1978) and the Theory of Equity (Walster et al., 1978) were used in one study (Forgeron et al., 2013) to partially explain the results, specifically the decrease in the time spent with friends based on a cost-benefit ratio. In other words, children and adolescents in pain spend less time with close friends because they need more time to fulfil their needs related to the pain condition, and, consequently, their friends look for alternative partners.

The SIP (Crick & Dodge, 1994) model was used in one study (Forgeron et al., 2011) to lead the study and to assess, through narrative vignettes, whether the interpretation of friendship interactions was supportive or non-supportive. Results reflected a tendency among adolescents with chronic pain to interpret non-supportive social situations with close friends as more distressing.

Discussion

In relation to the first objective, there is great variability in pain conditions, samples, and sources of information, as well as in the designs, methodologies, instruments, and variables measured. Moreover, features related to chronic pain (i.e., frequency, intensity, disability) are not uniformly described or used to explain friendships. Furthermore, variables related to this topic are usually assessed as secondary measures rather than primary outcomes. All of these considerations make it difficult to compare results, or even to summarise them with details and within an integrative discourse.

Although the quality assessment indicates that all studies included are methodologically acceptable, our second objective is not fully met. This was mainly done for two reasons. First, given that only six out of the 20 selected articles focus on peer and friend relationships, our targeted topic (peers and friends) is only partially addressed in the studies, or it is included in a general category of social functioning (which might include family, teachers, etc.). The second reason is that the studies reviewed do not clearly identify and cite the mechanisms as such, and therefore the process of extracting and identifying mechanisms carried out in the present study might sometimes be based on implicit information or on authors' judgements. To the best of our knowledge, until 2002 there were no studies that explicitly or implicitly addressed mechanisms involved in friendships of children and adolescents with chronic pain. Since then, this area of study has grown slightly, and has been mainly developed and described by Forgeron's studies, as shown in three of the selected articles (Forgeron & McGrath, 2008; Forgeron et al., 2011; Forgeron et al., 2013) and three others that has been excluded (Fales & Forgeron, 2014; Forgeron

et al., 2015; Forgeron et al., 2010) because they do not fully meet the inclusion criteria.

The majority of the studies address two mechanisms: Emotional and Failure-focused avoidance and Disclosure, communicative, and assertive skills. The first one leads to isolation by promoting the avoidance of the social situations that might expose the child or the adolescent to uncomfortable feelings, or to others' lack of empathy, disbeliefs and judgments. On the contrary, the second mechanism promotes the involvement of the children or the adolescent by talking properly with others about their needs. It might be a good mechanism to seek social support which, in turn, could act as a protective factor.

Among the mechanisms that alienate children and adolescents from others are Interpretation of others' behavior as non supportive, Catastrophizing and No disclosure, that might appear interrelated. In other words, fear of rejection and judgements and being worried and keep on thinking about the pain, might be related to not disclosing about the pain condition and related disability. In contrast to that, Hiding pain and Maintaining activities and friendships (sharing common interests) have a protective role at first when adolescents struggle to be and act normal when dealing with their pain (Forgeron & McGrath, 2008; Forgeron et al., 2013; Meldrum et al., 2009). Both might be a good distraction from pain and help them to gain confidence and engage in disclosure. In some cases, and particularly in the onset of chronic pain, they are no longer able to identify with the same activities they did before, activities that had helped them to define who they are; consequently, they have to Rethink their social self. This leads to identifying their current needs and displaying more adaptive mechanisms (Forgeron et al., 2013). Only one involvement mechanism was identified from peers and friends behavior: Not rewarding pain behaviors (not focusing on pain). It supports appropriateness of behaviors, cognitions, or responses that encourage children to enact adaptive behaviours (Castarlenas et al., 2015; Forgeron et al., 2011). The majority of mechanisms were identified in more than one study. However, some of them are identified just once. Among them, and promoting isolation, we found Behavioral disengagement, Rewarding pain behaviors, and Looking for alternative friends (from friends and peers perspective). On the other hand, and as a mechanism than can promote involvement, we identified Looking for alternative activities/friends behavior. Finally, the Rethinking friendships mechanism has been related to both involvement and isolation.

Social peers and friends functioning occurs essentially in a relational and dynamic situation. Most studies only provide static data from the point of view of one of the actors involved (i.e., a child or adolescent with chronic pain, a healthy peer, parent, practitioner, and teacher). As Table 2 shows, there is little evidence about mechanisms involved from peers and friends' perspective. The absence of data might be due to the fact that few articles include the perspective of healthy participants.

Regarding the current evidence in relation to the third objective, only 3 studies are theory-driven, and thus follow the FAM model (Caes et al., 2015), the SIP model (Forgeron et al., 2011), and the Lazarus' theory (Bandell-Hoekstra et al., 2002). As commented in the introduction section, social support help an individual to cope with stressful situations, such as pain. Children and adolescents who suffer from more pain severity tend to cope with stressful situations by seeking social support, and showing internalizing and externalizing behaviors, among others (Bandell-Hoekstra et al., 2002). If they do not feel competent about their skills for discussing pain (cognitive appraisal from Lazarus' theory), then they will think that nothing can be done to change the situation (Forgeron & McGrath, 2008). The SIP model (Crick & Dodge, 1994) explains how supportive and non-supportive interpretation of social situations takes place, showing that adolescents with chronic pain have a tendency to interpret non-supportive social situations as more distressing (Forgeron et al., 2011). And finally, FAM (Vlaeyen & Linton, 2000) explains how pain-related anxiety is associated with

greater impairment in social functioning. In other words, these three theories are those that best contribute to explaining what is happening in peer and friend relationships of these children and adolescents. Interpretation of other's behavior as supportive or non-supportive and appraisal of own competence to discuss pain explain which mechanism would be chosen to deal with stressful situations: the ones listed in Table 2 that promotes involvement or isolation. Similarly, pain-related anxiety might play an important role as mediator in the mechanism used to manage the stressful situation and, consequently, affect the level of impairment of social functioning.

It is worth noting that the Social Communication Model of Pain (Craig, 2009; Craig, 2015), which postulates that interpersonal factors (such as peer and friend relationships) are relevant in understanding individuals' pain experiences and expressions, although it has been used previously in the paediatric pain context (Forgeron & King, 2013), has not been cited in any article reviewed.

Limitations

The literature on recurrent and chronic pain usually merges different pain problems, and so it is possible that our exclusion criteria (pain problems listed) limited our search to a reduced number of studies to review. Likewise, few studies assess peers and friends' behavior without clearly differentiating it from behavior of other people in a child's environment (e.g., teachers).

In another vein, there might be a certain degree of subjective bias and overlapping in the definition of mechanisms as they are extracted and formed based on author judgments.

Finally, as we have focused our search on the most salient ones in psychology and health field databases, it is possible that our review has not captured all empirical studies on direct or indirect aspects of peer and friend relationships in children and adolescents with chronic pain listed conditions.

Conclusions

From this review we can draw two main conclusions. First, peer and friend relationships in children and adolescents with chronic pain are not a uniform experience, and are contextually specific. However, there are a few common trends: impairment in activities and contact with peers and friends (i.e., fewer friends, isolation); self-identity difficulties, feeling different from others; and others' lack of understanding and disbelief about the pain condition. Consequently, they use similar mechanisms to deal with these difficulties. Each of these mechanisms leads children and adolescents to isolation from or involvement in their peer and friend relationships, as has been described. Second, traditionally, literature suggests conducting theory-driven research to advance (Karmiloff-Smith & Inhelder, 1974). However, according to our results, most of the articles only cite a theory as a reference, and just three of them are theory driven (Bandell-Hoekstra et al., 2002; Forgeron et al., 2011; Pluye et al., 2011). Moreover, only Lazarus theory was cited in more than one study and was used to provide a comprehensible peer and friend relationships explanation. In any case, none of the studies were designed to test a specific theory.

Finally, assuming that mechanisms are dynamic, modifiable, and potentially active processes when confronting pain (Cousins et al., 2015), these findings should be taken into account when designing and planning interventions aimed toward strengthening some mechanisms (e.g. Disclosure, communicative, and assertive skills) and prevent from others (e.g. Emotional and failure-focus avoidance), in order to promote social involvement in adolescents with chronic pain.

Conflict of Interest

The authors of this article declare no conflict of interest.

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Supplementary Table S1. Search Strategy with PUBMED

01. <i>pain</i> [Title/Abstract]	09. 02 or 03 or 05 or 06 or 07 or 08	17. Humans	25. 15 and 24
02. <i>child</i> * [Title/Abstract]	10. <i>peer</i> * [Title/Abstract]	18. English	
03. <i>school age</i> [Title/Abstract]	11. <i>friend</i> * [Title/Abstract]	19. Spanish	
04. <i>infant</i> * [Title/Abstract]	12. <i>interpersonal</i> [Title/Abstract]	20. 18 or 19	
05. <i>adolescent</i> * [Title/Abstract]	13. <i>social</i> * [Title/Abstract]	21. Child: 6-12 years	
06. <i>juvenile</i> [Title/Abstract]	14. 10 or 11 or 12 or 13	22. Adolescent: 13-18 years	
07. <i>teen</i> * [Title/Abstract]	15. 01 and 09 and 14	23. 21 or 22	
08. <i>young</i> * [Title/Abstract]	16. Journal articles	24. 16 and 17 and 20 and 23	

Supplementary Table S2. Search Strategy with PsycINFO

01. <i>child</i> * [Abstract]	09. 07 or 08	17. <i>teen</i> * [Title]	25. 23 or 24	33. <i>interpersonal</i> [Title]	41. Human
02. <i>child</i> * [Title]	10. <i>adolescent</i> * [Abstract]	18. 16 or 17	26. <i>peer</i> * [Abstract]	34. 32 or 33	42. School age
03. 01 or 02	11. <i>adolescent</i> * [Title]	19. <i>young</i> * [Abstract]	27. <i>peer</i> * [Title]	35. <i>social</i> * [Abstract]	43. Adolescence
04. <i>school age</i> [Abstract]	12. 10 or 11	20. <i>young</i> * [Title]	28. 26 or 27	36. <i>social</i> * [Title]	44. 42 or 43
05. <i>school age</i> [Title]	13. <i>juvenile</i> [Abstract]	21. 19 or 20	29. <i>friend</i> * [Abstract]	37. 35 or 36	45. 40 and 41 and 44
06. 04 or 05	14. <i>juvenile</i> [Title]	22. 03 or 06 or 09 or 12 or 15 or 18 or 21	30. <i>friend</i> * [Title]	38. 28 or 31 or 34 or 37	46. 39 and 41
07. <i>infant</i> * [Abstract]	15. 13 or 14	23. <i>pain</i> [Abstract]	31. 29 or 30	39. 22 and 25 and 38	
08. <i>infant</i> * [Title]	16. <i>teen</i> * [Abstract]	24. <i>pain</i> [Title]	32. <i>interpersonal</i> [Abstract]	40. Peer review journal	

Supplementary Table S3. Search Strategy with Web of Science

01. <i>pain</i> [Title/Abstract]	09. 02 or 03 or 04 or 05 or 06 or 07 or 08	17. English
02. <i>child</i> * [Title/Abstract]	10. <i>peer</i> * [Title/Abstract]	18. Spanish
03. <i>school age</i> [Title/Abstract]	11. <i>friend</i> * [Title/Abstract]	19. 17 or 18
04. <i>infant</i> * [Title/Abstract]	12. <i>interpersonal</i> [Title/Abstract]	20. 16 and 19
05. <i>adolescent</i> * [Title/Abstract]	13. <i>social</i> * [Title/Abstract]	21. 15 and 2
06. <i>juvenile</i> [Title/Abstract]	14. 10 or 11 or 12 or 13	
07. <i>teen</i> * [Title/Abstract]	15. 01 and 09 and 14	
08. <i>young</i> * [Title/Abstract]	16. Article	

Supplementary Table S4. Assessment Tools for Quantitative Studies (continued)[illegible]

Supplementary Table S4. Assessment Tools for Quantitative Studies (continuation)

	Bandell-Hoekstra et al., 2002	Caes et al., 2015	Castarlenas et al., 2015	Eccleston et al., 2005	Forgeron et al., 2013	Greco et al., 2007	Guite et al., 2007	Karwautz et al., 1999	Kashikar-Zuck et al., 2007	Konijnenberg et al., 2005	Langeveld et al., 1996	Larsson et al., 2007	Metsähonkala et al., 1998	Vannatta et al., 2008	van Tilburg et al., 2015
21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	-	-	-	-		Y	-	Y	Y	-	-	-	Y	Y	Y
22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?	-	-	-	-	U	U	-	Y	Y	-	-	-	N	Y	N
25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	N	-	-	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y
26. Were losses of patients to follow-up taken into account?	-	-	-	-	-	-	-	-	-	-	Y	Y	-	-	-
Overall score	10	11	10	14	14	14	12	14	14	11	13	14	14	16	15

Note: Y = Yes; N = No; U = unable to determinate; - = not applicable.

Supplementary Table S5. Assessment Tools for Qualitative Studies

	Carter et al., 2002	Donovan et al., 2013	Forgeron et al., 2013	Forgeron et al., 2008	Meldrum et al., 2009
1. Was there a clear statement of the aims of the research?	YES	YES	YES	YES	YES
2. Is a qualitative methodology appropriate?	YES	YES	YES	YES	YES
3. Was the research design appropriate to the aims of the research?	YES	YES	YES	YES	YES
4. Was the recruitment strategy appropriate to the aims of the research?	YES	YES	YES	YES	YES
5. Was the data collected in a way that addressed the research issue?	YES	YES	YES	YES	YES
6. Has the relationship between researcher and participants been adequately considered?	YES	YES	YES	CAN'T TELL	YES
7. Have ethical issues been taken into consideration?	YES	YES	YES	YES	YES
8. Was the data analysis sufficiently rigorous?	YES	YES	YES	YES	YES
9. Is there a clear statement of findings?	YES	YES	YES	YES	YES
10. How valuable is the research?	YES	YES	YES	YES	YES

