Defining Growing Pains: A Scoping Review

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abstract

BACKGROUND AND OBJECTIVES: Up to one third of children may be diagnosed with growing pains, but considerable uncertainty surrounds how to make this diagnosis. The objective of this study was to detail the definitions of growing pains in the medical literature.

METHODS: Scoping review with 8 electronic databases and 6 diagnostic classification systems searched from their inception to January 2021. The study selection included peer-reviewed articles or theses referring to "growing pain(s)" or "growth pain(s)" in relation to children or adolescents. Data extraction was performed independently by 2 reviewers.

RESULTS: We included 145 studies and 2 diagnostic systems (ICD-10 and SNOMED). Definition characteristics were grouped into 8 categories: pain location, age of onset, pain pattern, pain trajectory, pain types and risk factors, relationship to activity, severity and functional impact, and physical examination and investigations. There was extremely poor consensus between studies as to the basis for a diagnosis of growing pains. The most consistent component was lower limb pain, which was mentioned in 50% of sources. Pain in the evening or night (48%), episodic or recurrent course (42%), normal physical assessment (35%), and bilateral pain (31%) were the only other components to be mentioned in more than 30% of articles. Notably, more than 80% of studies made no reference to age of onset in their definition, and 93% did not refer to growth. Limitations of this study are that the included studies were not specifically designed to define growing pains.

CONCLUSIONS: There is no clarity in the medical research literature regarding what defines growing pain. Clinicians should be wary of relying on the diagnosis to direct treatment decisions.

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Growing pains are proposed to be 1 of the most common causes of recurrent musculoskeletal pain in children.[1] The term first emerged in 1823 in a book called "Maladies de la Croissance" ("diseases of growth").[2] Reported estimates of the prevalence of growing pains range from 3.5% to 36.9%, depending on the country, setting, and definition.[3–7]

Although growing pains appears a popular diagnostic label in children and adolescents, there is uncertainty about what constitutes growing pain.[1] Critically, it is unclear if growing pains is a diagnosis of exclusion for nonspecific musculoskeletal pain presentations, or if it is intended as an explanation for a specific musculoskeletal condition or pathology. Many causes of growing pains have been proposed. These include anatomic causes (eg, hypermobility, genu valgum, low bone mineral density),[10] psychological causes (eg, stress),[4,11] vascular causes (eg, skeletal vascular perfusion),[8] and metabolic causes (eg, low vitamin D levels).[12] All of these causes are either unsupported by research, or underpinned by inconsistent evidence.[9,12–14] This uncertainty means there is a lack of guidance for clinicians as to when the label growing pains might be appropriate for a patient.

To our knowledge, there is no systematic exploration of how growing pains are defined or diagnosed in the literature. Given the lack of clarity around this popular clinical term, a comprehensive synthesis of how growing pains are currently defined, may progress knowledge of the "condition." The aim of this scoping review was to identify how growing pain(s) are defined in the peer-reviewed clinical literature and diagnostic systems such as the International Classification of Diseases (ICD).

METHODS

Data Sources

This review was prospectively registered on International Prospective Register for Systematic Reviews (PROSPERO CRD42019117495) and is reported in accordance with the PRISMA extension for scoping reviews (PRISMA-ScR).[15] We collected data from 2 distinct sources, medical journals and disease classification systems. For studies in medical journals, we searched Medline, Embase, CINAHL, AMED, PEDro, PsycINFO, Scopus and Dissertations and Theses from their inception to January 29, 2021. We used the search term "grow* pain*" in each database. We examined reference lists and performed citation tracking of included studies to identify further studies. Two authors independently screened records by titles and abstracts in Covidence. Two authors read full-texts of potentially eligible studies to determine eligibility. Disagreements were resolved through discussion. For disease classification systems, we searched six databases: READ,[16] ICD (International Classification of Diseases (ICD)-1017, ICD-11,[18] Systematised Nomenclature of Medicine (SNOMED),[19] The Diagnostic and Statistical Manual of Mental Disorders (DSM)-5[20] and the International Classification of Primary Care (ICPC)-2.[21] We searched each database with the search terms growing pain(s) or 'growth pain(s)'.

Study Selection

We included any peer-reviewed, full-length article, thesis, or dissertation that contained text referring to the terms growing pain(s) or growth pain(s) in relation to children or adolescents. Conference abstracts, studies with an available abstract only and studies written in non-English languages where a translation could not be arranged were excluded. No non-English studies were deemed eligible for inclusion. We included any medical code referring to growing pain(s) or growth pain(s) in the 6 disease classification systems.

Data Extraction and Synthesis

Two authors independently extracted data from the studies and disease classification systems. Where necessary, we contacted study authors by e-mail to obtain information not reported in the articles – 13 authors were emailed for information. The following data were extracted from each study: study author, publication year and country, study design, population and setting description, study aims, definition and/or diagnostic description for growing pains. The following information was extracted from the disease classification systems: database name, medical record diagnosis code and definition.

Our outcome was the definition of growing pains reported.

We did not conduct risk of bias assessment of included studies. We did not deem risk of bias (quality) assessment applicable since this review focused on reporting the definitions and diagnostic criteria.

We defined 8 components of the definitions and reported summary statistics of characteristics within each category.

RESULTS

Our search identified 2967 unique studies (after removal of duplicates). Following screening of study titles and abstracts, we retained 167 studies for full-text assessment, 145 studies met our inclusion criteria and were included in the review (Fig 1).

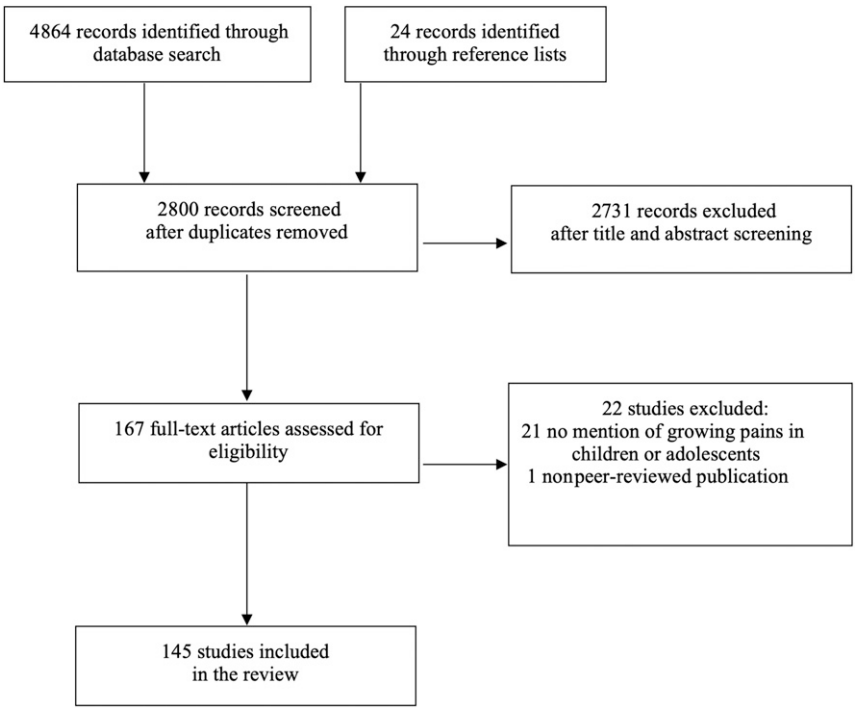

FIGURE 1
Flowchart of the included studies.

We included cross-sectional studies ($n = 45$),[9–11,13,22–62] review articles ($n = 36$),[1,8,14,63–94] editorials, commentaries, and perspectives ($n = 17$),[3,95–110] retrospective observational studies ($n = 12$),[4,111–121] case reports ($n = 8$),[122–129] prospective observational studies ($n = 13$),[7,12,42,130–139] case-control studies ($n = 3$),[140–142] systematic reviews ($n = 2$),[143,144] case series ($n = 2$),[145,146] a thesis,[147] a content analysis,[148] a randomized trial,[149] a reliability and validity study,[30] a before and after study,[150] a quasi-experimental study,[151] and a qualitative focus group study[152] ($n = 1$ each). Our search of the 6 disease classification systems[16–21] retrieved 3 diagnostic codes for growing pains, 2 systems (ICD-10 and SNOMED) provided a definition or criteria (Table 1).

Forty-one included studies (28%) did not provide a definition or criteria for growing pain.[7,10,25,32,33,49,50,59–61,64,71,72,84,85,88,97,98,105,109–113,115,117,119,121–124,126–131,137,139,148,152]

TABLE 1 Disease Classification System Codes and Definitions

Database	Diagnosis Code	Definition
READ	None	None
ICD-10	Growing pains, children	Other and unspecified symptoms and signs involving the nervous and musculoskeletal systems
ICD-11	Growth pain disorder	None
SNOMED	Growing pains, growing pains in limbs	Episodic childhood musculoskeletal pain, usually brief (a few minutes), intense, nocturnal, involving both legs, with no identifiable cause or sequelae
DSM-5	None	None
ICPC-2	None	None

Characteristics of the definitions in the other 104 studies (72%) were categorized into 8 components: pain location, age of onset, pain pattern, pain trajectory, pain type and risk factors, relationship to activity, severity and functional disability, and physical examination and investigations. Table 2 provides a summary of the most commonly mentioned characteristics and Fig 2 provides a visual overview of the characteristics in the 8 categories. A detailed overview of each study is provided in the Supplemental Table 3.

Definitions and Diagnostic Criteria

Please see Table 2 for summary and Fig 2 for a detailed overview of results.

1. Pain Location

Forty-five studies (31%) stated that growing pain are bilateral in nature, and 1 study stated that growing pains were usually unilateral. The remaining 99 studies (68%) did not specify bilateral or unilateral.

Seventy-two studies (50%) stated that growing pains mainly affect the lower limbs or legs, and of these, 27 studies specifically mentioned the popliteal fossa and 13 the knees and shins. Other locations mentioned were arms ($n = 8$), shoulder, back, groin, or ligaments and tendons (all $n = 1$). Fifty-seven studies (39%) did not mention the location of growing pains.

Forty studies (28%) stated that growing pains were not joint-related (ie, nonarticular), and 3 claimed that they were. There were 102 studies (70%) that did not refer to joint involvement. Thirty-nine studies (27%) stated that growing pains were muscular, whereas 106 studies (73%) did not refer to muscular involvement.

TABLE 2 Most Commonly Mentioned Characteristics of Growing Pains

[a]Component of the Definition	Characteristic
Pain location	Bilateral pain
	Lower limb pain
	No joint pain
	Muscular pain
Pain pattern	Evening or night pain
	Absence of morning pain
Pain trajectory	Episodic or recurrent
Physical examination and investigations	Normal physical examination
	Normal radiography or laboratory findings

[a]Characteristic mentioned in at least 20% of definitions.

One diagnostic system specified bilateral, lower limb symptoms (SNOMED).

2. Age of Onset

Twelve studies (8%) stated that growing pains occur between 3 and 12 years old, and most other studies reported within that same range with only 3 studies extending the age range to 13, 14, and 15 years old, respectively. 122 studies (83%) did not refer to the age of onset.

3. Pain pattern

Seventy studies (48%) stated that growing pains occur only in the evening or nighttime, 75 studies (52%) did not mention evening or night pain. Thirty-one studies (21%) stated that growing pains are absent in the morning, whereas only 1 stated possible morning presence. There were 113 studies (78%) that made no reference to the morning time.

There was wide variation regarding duration of episodes, ranging from minutes to hours ($n = 3$[13,35,136]), 30 to 60 minutes ($n = 1$), 30 minutes to 2 hours ($n = 1$), under 72 hours ($n = 5$), and over 72 hours ($n = 1$).

One diagnostic system described growing pain as nocturnal and usually lasting for a few minutes (SNOMED).

4. Pain Trajectory

Sixty-one studies (42%) stated that growing pains are episodic or recurrent, 21 (14%) stated that they are often persistent in nature, and 16 of these stated that a diagnosis of growing pains can only be made if the child or adolescent has pain for over 3 months. Seven studies (5%) specifically stated that growing pains are not persistent in nature.

Four studies (3%) stated that growing pains occur daily, whereas 2 studies (1%) stated that growing pains present once or twice a week. Single studies stated that growing pains occur at least monthly and at least twice in 1 year.

Three studies (2%) mentioned that growing pains resolve with time and maturity. Seventy-one studies (49%) did not refer to the trajectory of growing pains.

One diagnostic system described growing pain as episodic (SNOMED).

5. Pain Type and Risk Factors

Nineteen studies (13%) referred to the vague or unknown nature of growing pains.

Seven studies (5%) stated that growing pains are or can be related to growth, 2 studies (1%) stated that they are unlikely to be caused by growth, and 1 study stated that growing pains occur during a period of declining growth. The remaining 135 studies (93%) did not refer to the relationship between growth and growing pains.

Ninety-six studies (66%) did not refer to pain type or possible causes of growing pains.

One diagnostic system described growing pain as of "other cause" or "unspecified cause" (ICD-10), and 1 as of "no cause" (SNOMED).

6. Relationship to Activity

Fourteen studies (10%) stated that growing pains do not interfere with ability to engage in physical activity, and 120 studies (83%) did not refer to the relationship between activity and growing pains.

7. Severity and Functional Impact

Seventeen studies (12%) stated that pain intensity can vary from mild to severe, and 128 studies (88%) did not refer to pain intensity.

Twenty-four studies (17%) stated that individuals with growing pains do not present with limitations in walking or exercise ability, whereas 4 studies (3%) stated that individuals may experience walking difficulties. There were 117 studies (81%) that did not refer to functional limitations.

Fifteen studies (10%) mentioned that individuals with growing pains may have difficulty sleeping or they may wake at night, and 130 studies (90%) did not refer to sleep.

One diagnostic system describes the severity of growing pain as "intense" (SNOMED).

8. Physical Examination and Investigations

Fifty-one studies (35%) stated that individuals with growing pains present with a normal physical examination, defined as an absence of swelling, infection, range of motion deficits, gait abnormalities, and musculoskeletal impairments, and 93 studies (64%) did not refer to physical examination findings.

Thirty-one studies (21%) stated that individuals with growing pains present with normal radiography (eg, x-ray) and laboratory investigations (eg, rheumatoid factor

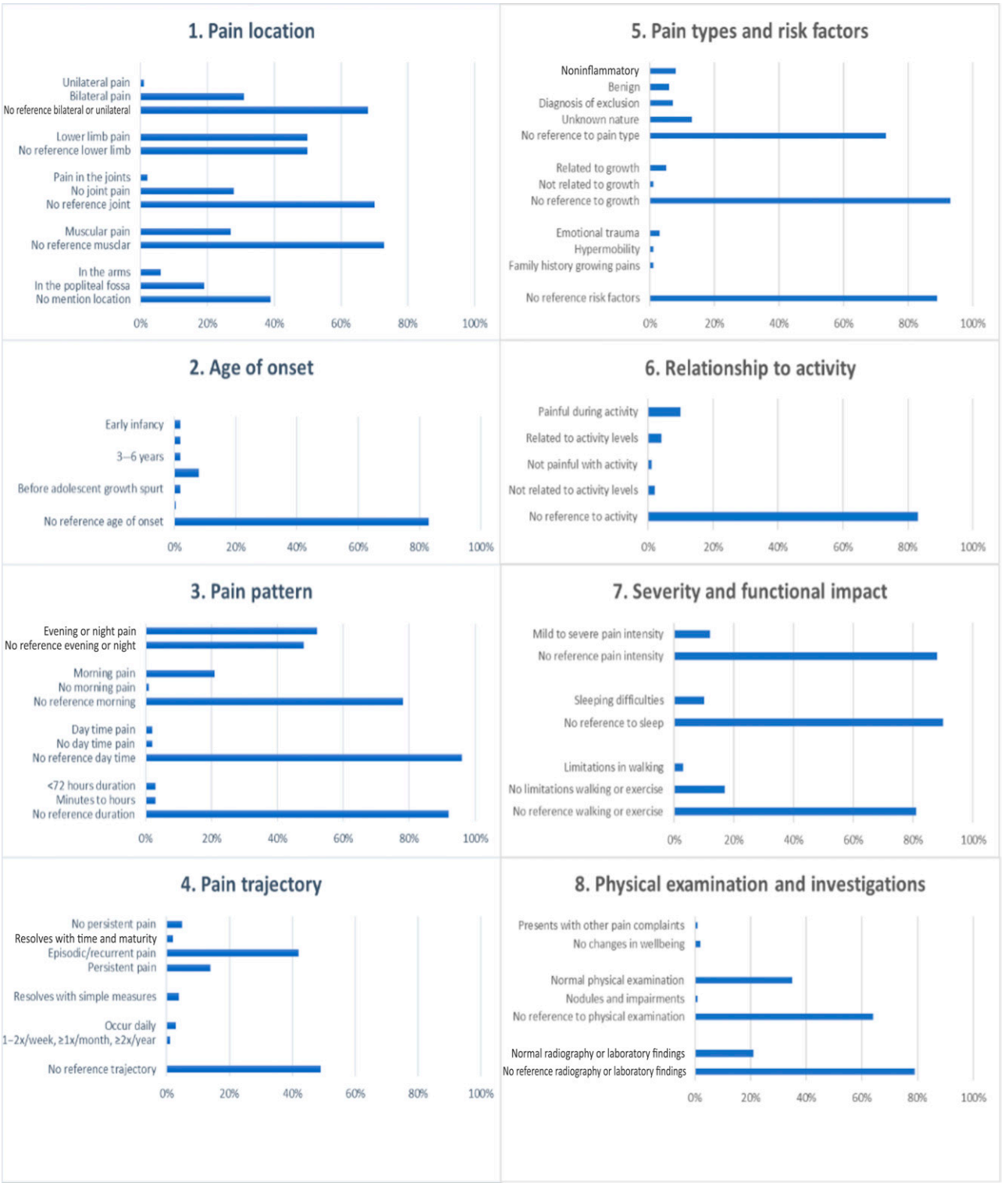

FIGURE 2
Characteristics of growing pain definitions. Note: percentages refer to the proportion of studies that specified this feature.

or complete blood count), and 114 (79%) studies did not refer to radiography or laboratory findings.

DISCUSSION

This scoping review shows there is no consensus about how to define growing pains and how the diagnosis can be made in clinical practice. Relevant literature is

characterized by contradictions, eg, specifically in the arms versus in the lower limbs and absence of reference to specific defining features, eg, location, age of onset, relationship with activity. Lower limb pain (50% of studies), evening or night pain (48%), episodic or recurrent pattern (42%), normal physical assessment (35%) and bilateral pain (31%) were the only specific indicators mentioned in at least 30% of the references. It is particularly noteworthy that more than 80% of studies made no reference to age of onset in their definition, and 93% did not refer at all to growth in their definition of growing pains.

The strength of this review is that we included all study designs and performed a sensitive search in a number of databases and disease classification systems. Two independent reviewers extracted data. We conducted the review in line with current recommendations for scoping reviews. A limitation of the review is that the included studies were not specifically designed to define growing pains so some articles may not have explicitly reported definitions or criteria that were used by researchers in a particular study. Sixteen different study designs featured in our review. The specific aims of these studies varied, and this may explain some of the variability in definitions. Conversely, it might be considered a strength that our study captures how the diagnosis is reported in research and as such describes what is available to consumers of research evidence in the field.[153–155]

Although the most comprehensive overview of the way growing pains are defined and used in research, ours is not the first study to point out some important issues with the concept. Several authors have noted that growing pains is used as a diagnosis of exclusion,[1,156] and further, that etiology is unknown.[87,144] Perhaps the most striking finding from our review is the disturbing inconsistency in definitions; a result that reinforces calls from Walters et al[90] for standardized diagnostic criteria.

Interestingly, very few studies refer to the relationship between growth and growing pain, which reflects uncertainty as to the role of growth as a contributing factor. Further, from this scoping review we are unable to draw a conclusion about the affectation of growing pain, whether the origin is in joints or muscles. This is because although 40 of our included studies (28%) stated that growing pains were not joint-related, 102 studies (70%) did not refer to joint involvement. We see a similar picture for muscular involvement; 39 studies (27%) stated that growing pains were muscular, but 106 studies (73%) did not refer to muscular involvement. This lack of clarity along with the generally accepted view that pathophysiology is unknown raises the possibility that growing pains is a misnomer. Several of the included studies expressed this issue.[14,26,78,81,103] These studies proposed a number of alternative terms: "recurrent limb pain in childhood," "benign nocturnal limb pains of childhood," "benign leg ache in children," and "idiopathic limb pain."

From a clinical perspective, there may be value in better understanding the decision-making process around the labels clinicians use with children and adolescents with musculoskeletal pain. We did not locate any qualitative studies on this topic. One survey study showed that physicians feel it is important to order investigations to exclude other provisional diagnoses before assigning a diagnosis of growing pains.[41] Literature from other health areas (eg, low back pain, cancer, conjunctivitis, polycystic ovary syndrome, or gastroesophageal symptoms) show that labels provided to patients to explain health conditions or symptoms can influence beliefs and treatment preferences.[157–161] We currently do not know the relative benefits and harms of providing a diagnosis of growing pains.

Given that prevalence may be as high as 37%, the fact that pathophysiology is unknown and compelling evidence of substantial variance in application of the label, point to a clear need for better understanding of pain in children. This echoes previous calls for research to provide clearer guidance for clinical practice. Specifically, researchers should not use the diagnostic term growing pains by itself to categorize study participants or as an explanatory variable. The term is used in such a heterogenous manner that it will render their study uninterpretable. If the diagnosis is to be used, we recommend clear description of the clinical characteristics used to define growing pains in that particular study.

Absence of a clear definition of growing pains may lead to misclassification of patients and result in specific causes of musculoskeletal pain in children or adolescents being missed. Interestingly, the Peterson criteria does not refer to growth as a feature of growing pains The Peterson criteria say that the pain usually occurs once or twice per week. Most of the studies included in our review did not document this. The Peterson criteria say that growing pains are neither related to activity nor affect activity. Most of the studies included in this review did not comment on activity. So, we are left asking the question why is the word "growing" used in the first place?

CONCLUSIONS

There is substantial variability and lack of clarity in how growing pains are defined in the literature. Clinicians and researchers using the term should clearly describe the clinical criteria they use to define growing pains, because the diagnosis itself means different things to different people.

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