

**Literature Search** [according to Moher et al., Green et al., Armstrong & Waters, Chiquette & Posey, Richardson & Wilson, Booth, Sampson et al., Maggio et al., DELBI (Fassung 2008), The National Academies (Standards March 2011)]

**a) Primary Search**

Databases/Sources <i>(Search performed 10/2012 - 03/2013)</i>	Keywords and Boolean operators: Number or records (n) included for full-text eligibility assessment / Number of records (n) identified							Records screened (n)  based on English or German titles, abstracts, publication dates (03/1998-03/2013)	Duplicates (n)	Records excluded (n) including duplicates + records assessed as not eligible (based on criteria as in Table 1b evaluated for titles and abstracts)	Records included (n) for full text eligibility-assessment  (Table b)
	Children and adolescents and musculoskeletal pain and primary care  (Kinder und Knochenschmerzen)	PMSP and primary care	PMSP and primary care and review	PMSP and epidemiology  (Kinder und Jugendliche und Knochen-schmerzen und Epidemiologie)	PMSP and etiology  (Kinder und Jugendliche und Knochen-schmerzen und Aetiologie)	PMSP and differential diagnosis  Kinder und Jugendliche und Knochen-schmerzen und Differenzial-diagnose	PMSP and a) cancer b) trauma c) child abuse d) infection e) inflammatory/rheumatic disease				
MEDLINE - National Library of Medicine [http://www.ncbi.nlm.nih.gov/pubmed]	11/39	4/27	2/14	18/50	35/150	5/161	a) 3/47 b) 3/61 c) 0/ 3 d) 1/24 e) 2/15	591	102	507	84
Deutsches Ärzteblatt [http://www.aerzteblatt.de/archiv/recherche]	0/3	n/a	n/a	0	0/1	1/1	n/a	5	1	4	1
Deutsche Gesellschaft für Kinder- und Jugendmedizin (DGKJ) [www.dgkj.de]/Monatsschrift Kinderheilkunde [http://www.springermedizin.de/monatsschrift-kinderheilkunde-2012-01/2309428.html]	6/6	n/a	n/a	0	0	0	n/a	6	0	0	6
Gesellschaft für Pädiatrische Hämatologie und Onkologie (GPOH)/Klinische Pädiatrie [https://www.researchgate.net/journal/030]	6/22	n/a	n/a	n/a	n/a	n/a	n/a	22	0	16	6

0-8630_Klinische_Paediatrie]												
American Academy of Family Physicians [http://www.aafp.org/online/en/home.html]	4/103	n/a	n/a	n/a	n/a	n/a	n/a	103	0	99	4	
The Cochrane Library [http://www.thecochranelibrary.com/view/0/index.html]	1/47	1/43	0/43	0/9	0/6	0/5	n/a	153	67	151	2	
National Guideline Clearinghouse (NGC) [www.guideline.gov]	0/51	n/a	n/a	n/a	n/a	n/a	n/a	51	22	51	0	
Google books [http://books.google.com/advanced_book_search]	1/1	n/a	n/a	n/a	n/a	n/a	n/a	1	0	0	1	
Other, i. e. recommended by specialist/co-authors, teaching material (Lectures, talks, seminars etc.)	21 (+ 2 lectures)	n/a	n/a	n/a	n/a	n/a	n/a	23	0	0	23	
<b>Records identified and screened (n) (English and German titles, abstracts, publication dates 03/1998-03/2013:)</b>	<b>295</b>	<b>70</b>	<b>57</b>	<b>59</b>	<b>157</b>	<b>167</b>	<b>150</b>	<b>955</b>				
<b>Duplicates (n)</b>	<b>1</b>	<b>24</b>	<b>43</b>	<b>7</b>	<b>42</b>	<b>28</b>	<b>47</b>		<b>190</b>			
<b>Records excluded (n) (including duplicates + based on eligibility criteria as in Table b), evaluated for titles and abstracts)</b>	<b>243</b>	<b>65</b>	<b>55</b>	<b>41</b>	<b>122</b>	<b>160</b>	<b>141</b>			<b>826</b>		
<b>Records included (n) for full text eligibility-assessment (Table b)</b>	<b>52/295</b>	<b>5/70</b>	<b>2/57</b>	<b>18/59</b>	<b>35/157</b>	<b>6/167</b>	<b>9/150</b>				<b>129/955</b>	

Abbreviations and symbols: PMSP: pediatric musculo-skeletal pain; n/a: not analyzed, n: number

**b) Assessment of full text articles to be included in guideline**

Full text article	Article-Eligibility Criteria															Study results relevant for guideline	
	Study population: pediatric/adolescent	Re-view-article *	Cohort study/case report/questionnaire based study	Major information on pediatric musculoskeletal pain <i>and</i>													
				Epidemiology/region of MSP	Etiology	Evaluation/assessment	History taking	Physical exam	Laboratory diagnostics	Diagnostic imaging	DD trauma/mechanical pathology	DD pain syndrome (i.e. "growing pains, fibromyalgia)	DD cancer	DD infection	DD auto-immune-/rheumatic/inflammatory disease		associated disease
Huemer C: The child presenting with arthralgia or arthritis - what do we need to consider? Ther Umsch. 2012	✓	✓															✓
Weiser P. Approach to the patient with noninflammatory musculoskeletal pain. Pediatr Clin North Am. 2012	✓	✓															✓
Duey-Holtz AD et al.: Acute and non-acute lower extremity pain in the pediatric population: part I. J Pediatr Health Care. 2012	✓	✓															✓
Duey-Holtz AD et al.: Acute and non-acute lower extremity pain in the pediatric	✓	✓															✓

population: part II. J Pediatr Health Care. 2012																	
Duey-Holtz AD et al.: Acute and non-acute lower extremity pain in the pediatric population: part III. J Pediatr Health Care. 2012	✓	✓															✓
Jackson C et al.: Back pain in children: a holistic approach to diagnosis and management. J Pediatr Health Care. 2011	✓	✓	-														✓
Jansson A & Reinhardt D: Knochenschmerzen n. Monatsschr Kinderheilkd 2009	✓	✓															✓
Haas JP: Chronische muskuloskeletale Schmerzen bei Kindern und Jugendlichen. Monatsschr Kinderheilkd 2009	✓	✓															✓
Weller F: Knochen- und Gelenkschmerzen im Kindesalter. Kinder- und Jugendmedizin 5/2009	✓	✓															✓
Junnila L et al.: Chronic musculoskeletal pain in children. Part I. Initial Evaluation. Am Fam Phys 2008	✓	✓															✓
Schanberg MA & Connelly J: Evaluating and managing pediatric musculoskeletal pain in primary care. Humana Press 2008	✓	✓															✓
Patel DR et al.: Musculoskeletal diagnosis in	✓	✓															✓

adolescents. Adolesc Med State Art Rev. 2007																	
Mallesen PN and Beauchamp RD: Rheumatology: 16. Diagnosing musculoskeletal pain in children. CMAJ. 2001	✓	✓															✓
Buerk G et al.: Muskuloskelettale Schmerzen, Schmerz 2000	✓	✓															✓
O'Sullivan P et al.: Characteristics of chronic non- specific musculoskeletal pain in children and adolescents attending a rheumatology outpatient clinic: a cross-sectional study. Ped Rheumatology 2011	✓		✓														✓
Zapata AL et al.: Pain and musculoskeletal pain syndromes in adolescents. J Adolesc Health. 2006	✓		✓														✓
Konijnenberg AY et al.: Pain of Unknown Origin in Children Study Group. Children with unexplained chronic pain: do pediatricians agree regarding the diagnostic approach and presumed primary cause? Pediatrics. 2004	✓		✓														✓
Jordan KP et al: Annual consultation prevalence of regional musculoskeletal problems in primary care: an observational	✓	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓

study. BMC Musculoskelet Disord. 2010																	
Paladino C et al.:Estimated prevalence of musculoskeletal pain in children, who attend a community hospital]. Arch Argent. Pediatr. 2009	✓		✓	✓													✓
De Inocencio J: Epidemiology of musculoskeletal pain in primary care. Arch Dis Child. 2004a)	✓		✓	✓													✓
Clarke NM & Page JE: Vitamin D deficiency: a paediatric orthopaedic perspective. Curr Opin Pediatr 2012	✓	✓			✓												✓
Zapata AL et al.: Pain and musculoskeletal pain syndromes related to computer and video game use in adolescents. Eur J Pediatr. 2006	✓		✓		✓												✓
Diepenmaat AC et al.: Neck/shoulder, low back, and arm pain in relation to computer use, physical activity, stress, and depression among Dutch adolescents. Pediatrics. 2006	✓		✓		✓												✓
Connelly M and Schanberg L: Latest developments in the assessment and management of chronic musculoskeletal pain syndromes in children. Curr Opin Rheumatol. 2006	✓	✓				✓											✓

<p>Foster HE and Cabral DA: Is musculoskeletal history and examination so different in paediatrics? Best Pract Res Clin Rheumatol. 2006</p>	✓	✓			✓	✓	✓						✓
<p>Clinch J and Eccleston C: Chronic musculoskeletal pain in children: assessment and management. Rheumatology 48: 466-474, 2009</p>	✓	✓			✓								✓
<p>Wong KO et al.: Antinuclear Antibody, Rheumatoid Factor, and Cyclic-Citrullinated Peptide Tests for Evaluating Musculoskeletal Complaints in Children [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2012</p>	✓		✓					✓					✓
<p>McGhee JL et al.: Identifying children with chronic arthritis based on chief complaints: absence of predictive value for musculoskeletal pain as an indicator of rheumatic disease in children. Pediatrics. 2002</p>	✓		✓					✓			✓		✓
<p>Swischuk LE: Musculokeletal: what's different in children? Jumping from pool to pool; falls and slips; elbow hurts. Emerg Radiol.</p>	✓	✓						✓					✓

2011																	
Hempfling A et al.: Primary subacute epiphyseal and metaepiphyseal osteomyelitis in children. Diagnosis and treatment guided by MRI. J Bone Joint Surg 85-B: 559-564, 2003	✓	✓								✓							✓
Omlor GW et al.: C. Radiofrequenzablation bei Osteoidosteomen der Wirbelsaeule. Moeglichkeiten und Grenzen. Der Orthopaede 8: 618-622, 2012	✓	✓								✓							✓
Winkelmann S et al.: Therapy of osteoid osteomas -- always surgically?. Klin Padiatr. 2003	✓	✓									✓						✓
Knuepfer M et al.: Incipient spinal cord compression syndrome due to a herniation of calcified intervertebral disk in a young girl. Klin Padiatr. 2000	✓		✓								✓						✓
Harel L: Growing pains: myth or reality. Pediatr Endocrinol Rev. 2010	✓	✓										✓					✓
Buskila D: Pediatric fibromyalgia. Rheum Dis Clin North Am. 2009	✓	✓										✓					✓
Windschall D et al.: Wachstumsschmerzen. Haeufige Diagnose unklarer Aetiologie. Monatsschr Kinderheilkd 2009	✓	✓										✓					✓
Lowe RM and Hashkes PJ. Growing pains: a non inflammatory	✓	✓										✓					✓



pain syndrome of early childhood. Nat Clin Pract Rheumatol. 2008																	
Uziel Y & Hashkes PJ: Growing pains in children. Ped Rheumatology 2007	✓	✓									✓						✓
Asadi-Pooya AA and Bardbar MR: Are laboratory tests necessary in making the diagnosis of limb pains typical for growing pains in children? Pediatr Int. 2007	✓		✓								✓						✓
Sherry DD and Malleson PN: The idiopathic musculoskeletal pain syndromes in childhood. Rheum Dis Clin North Am. 2002	✓	✓									✓						✓
Anthony KK and Schanberg LE. Juvenile primary fibromyalgia syndrome. Curr Rheumatol Rep. 2001	✓	✓									✓						✓
Sherry DD: An overview of amplified musculoskeletal pain syndromes. J Rheumatol Suppl. 2000	✓	✓									✓						✓
Leitlinie Fibromyalgiesyndrom: <a href="http://www.awmf.org/leitlinien/detail/ll/041-004.html">http://www.awmf.org/leitlinien/detail/ll/041-004.html</a>	✓	✓															✓
Riccio I et al.: Musculoskeletal problems in pediatric acute leukemia. J Pediatr Orthop B. 2013	✓		✓									✓					✓
Tamashiro MS et al.: Discrimination of acute lymphoblastic	✓		✓									✓					✓

leukemia from systemic-onset juvenile idiopathic arthritis at disease onset. Clinics (Sao Paulo) 2011																	
Suri D et al.: Arthritic presentation of childhood malignancy: beware of normal blood counts. Rheumatol Int. 2011	✓		✓										✓				✓
Barrios L et al.: Burkitt's lymphoma presenting as an intermittent limp. Reumatol Clin. 2011	✓		✓										✓				✓
Hill D and Whiteside J: Limp in children: Differentiating benign from dire causes. J Family Practice 60: 193-197, 2011	✓		✓										✓				✓
Oztuerkmen S et al.: Delayed diagnosis of acute leukemia in a patient with bone pain and fracture. Turk J Pediatr. 2010	✓		✓										✓				✓
Gupta D et al.: Arthritic presentation of acute leukemia in children: experience from a tertiary care centre in North India. Rheumatol Int. 2010	✓		✓										✓				✓
Nothrath M & Teichert I: Onkologische Ursachen von Knochenschmerzen. Monatsschr Kinderheilkd 2009	✓		✓										✓				✓
Sinigaglia R et al.: Musculoskeletal manifestations in	✓		✓										✓				✓

pediatric acute leukemia. <i>J Pediatr Orthop.</i> 2008																	
Forgie SE & Robinson JL: Pediatric malignancies presenting as a possible infectious disease. <i>BMC Infectious Diseases</i> 2007	✓		✓									✓					✓
Gonzalves M et al.: Diagnosis of malignancies in children with musculoskeletal complaints. <i>Sao Paulo Med J.</i> 2005	✓		✓									✓					✓
Jones OY et al.: A multicenter Case-Control study on predictive factors distinguishing childhood leukemia from juvenile rheumatoid arthritis. <i>Pediatrics</i> 2006	✓		✓									✓					✓
Dorransoro MI et al.: Malignant disease presenting as rheumatic manifestations. <i>An Pediatr (Barc).</i> 2004	✓		✓									✓					✓
Parikh SN and Crawford AH: Orthopaedic implications in the management of pediatric vertebral and spinal cord tumors: a retrospective review. <i>Spine (Phila Pa 1976).</i> 2003	✓		✓									✓					✓
Trueworthy RC and Templeton KJ. Malignant bone tumors presenting as musculoskeletal pain. <i>Pediatr Ann.</i> 2002	✓	✓										✓					✓
Barbosa CM et al.: Musculoskeletal	✓		✓									✓					✓

manifestations as the onset of acute leukemias in childhood]. J Pediatr (Rio J). 2002																			
Trapani S et al.: Incidence of occult cancer in children presenting with musculoskeletal symptoms: a 10-year survey in a pediatric rheumatology unit. Semin Arthritis Rheum. 2000	✓		✓										✓						✓
Young G et al.: Recognition of common childhood malignancies. Am Fam Phys 2000.	✓		✓										✓						✓
Mehilman CT et al.: Pediatric vertebral and spinal cord tumors: a retrospective study of musculoskeletal aspects of presentation, treatment, and complications. Orthopedics. 1999	✓		✓										✓						✓
Cabral DA and Tucker LB: Malignancies in children who initially present with rheumatic complaints. J Pediatr. 1999	✓		✓										✓						✓
Mignemi ME et al.: The spectrum of group A streptococcal joint pathology in the acute care setting. Pediatr Emerg Care. 2012	✓		✓											✓					✓
Robert Koch Institut: Lyme-Borreliose. RKI-Informationen für Ärzte.	✓																		✓

<a href="http://www.rki.de/DE/Content/Infekt/EpidBull/Merkblätter/Ratgeber_LymeBorreliose.html?nn=2398076#doc2398672bodyText2">http://www.rki.de/DE/Content/Infekt/EpidBull/Merkblätter/Ratgeber_LymeBorreliose.html?nn=2398076#doc2398672bodyText2</a>																	
Keitzer R: Acute rheumatic fever (ARF) and poststreptococcal reactive arthritis (PSRA) - an update. Z Rheumatol. 64(5): 295-307, 2005	✓	✓															✓
Reinehr T et al.: Spondylodiscitis in childhood. Klin Padiatr. 1999	✓		✓										✓				✓
Borzutzky A et al.: Pediatric chronic nonbacterial osteomyelitis. Pediatrics 130: 1190-1197, 2012	✓		✓										✓				✓
Jansson A: Nichtbakterielle Osteitis. Diagnose und Differenzialdiagnose. Monatsschr Kinderheilkd 2009	✓	✓												✓			✓
Junnila L et al.: Chronic musculoskeletal pain in children. Part II. Rheumatic causes. Am Fam Phys 2008	✓	✓												✓			✓
Anthony KK and Schanberg LE: Assessment and management of pain syndromes and arthritis pain in children and adolescents. Rheum Dis Clin North Am. 2007	✓	✓												✓			✓
Davies K and Copeman A: The spectrum of paediatric and adolescent rheumatology.	✓	✓												✓			✓

Best Pract Res Clin Rheumatol. 2006																	
Petty RE et al.: International League of Associations for Rheumatology classification of juvenile idiopathic arthritis: second revision, Edmonton. J Rheumatology 31: 390-392, 2004	✓	✓												✓			✓
Jansson A et al.: Chronisch rezidivierende multifokale Osteomyelitis und andere nichtbakterielle Osteitiden. Dtsch Arztebl 2004	✓	✓												✓			✓
Schilling F et al.: Pelvic type of chronic recurrent multifocal osteomyelitis. Klin Padiatr. 2001	✓		✓											✓			✓
Deere KC et al.: Obesity is a risk factor for musculoskeletal pain in adolescents: findings from a population-based cohort. Pain 2012	✓		✓													✓	✓
Peitz J & Schoenau E: Knochenschmerzen aus endokrinologischer Sicht. Monatsschr Kinderheilkd 2009	✓	✓														✓	✓
Theodorou DJ et al.: Skeletal muscle disease: patterns of MRI appearances. Br J Radiol. 2012		-															-
Huibers LA et al.: Diagnostic scope in out-of-hours primary care	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-

services in eight European countries: an observational study. BMC Fam Pract. 2011																		
Hoeffel C et al.: Pyogenic spondylitis with Scheuermann's disease. Klin Padiatr. 2000	✓		✓										✓					-
Siu DC et al.: Computer products usage and prevalence of computer related musculoskeletal discomfort among adolescents. Work. 2009	✓	-	✓		✓	-	-	-	-	-	-	-	-	-	-	-	-	-
Kroonen LT et al.: Prader-Willi Syndrome: clinical concerns for the orthopaedic surgeon. J Pediatr Orthop. 2006	-																	-
Schmitz A et al.: Sacral osteoid osteoma--a rare cause of back pain in childhood and adolescence. Klin Padiatr. 2000	✓	✓									✓							-
De Inocencio et al.: Joint hypermobility: prevalence and relationship with musculoskeletal pain. An Pediatr (Barc). 2004b	✓		✓								✓							-
Shah VN et al.: Influence of age and gender on presentation of symptomatic primary hyperparathyroidism. J Postgrad Med. 2012	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-
De Inocencio J: Musculoskeletal pain in primary pediatric care:	✓		✓		✓													- <i>(ref. in De</i>

analysis of 1000 consecutive general pediatric clinic visits. <i>Pediatrics</i> . 1998																			Inocencio 2004a)
Reamy BV & Slokey JB: Adolescent idiopathic scoliosis : Review and current concepts. <i>Am Fam Phys</i> 2001	✓	✓			✓														-
Ward L et al.: Biophosphonate therapy for children and adolescents with secondary osteoporosis. <i>Cochrane database of systematic reviews</i> 2007.	✓	✓															✓		-
Alshryda SJM et al.: Interventions for treating slipped upper femoral epiphysis. <i>Cochrane database of systematic reviews</i> 2013	✓	✓									✓								-
Patel DR & Nelson TL: Sports injuries in adolescents. <i>Med Clin North Am</i> . 2000	✓	✓									✓								-
Grady MF & Goodman A: Common lower extremity injuries in the skeletally immature athlete. <i>Curr Probl Pediatr Adolesc Health Care</i> . 2010	✓	✓									✓								-
Siegel DM: Chronic arthritis in adolescence. <i>Adolesc Med State Art Rev</i> . 2007	✓	✓															✓		-
Clinch J et al.: Epidemiology of generalized joint laxity (hypermobility) in fourteen-year-old	✓		✓																-



children from the UK: a population-based evaluation. Arthritis Rheum. 2011																			
Selbst SM et al.: Back pain in children who present to the emergency department. Clin Pediatr (Phila). 1999	✓	✓																	-
Zernikow B et al.: Characteristics of highly impaired children with severe chronic pain: a 5-year retrospective study on 2249 pediatric pain patients. BMC Pediatr. 2012	✓		✓																-
Micucci CJ et al.: Hip pain as initial presentation for varicella-zoster infection in an adolescent male. Orthopedics. 2011	✓		✓																-
Backes J et al.: Septic knee-induced deep venous thrombosis in a young adult. Orthopedics. 2010	-																		-
Sirelkhatim A et al.: Systemic malignancies presenting as primary osteolytic lesion. Bratisl Lek Listy. 2009	-																		-
Spapens N et al.: Thoracolumbar intervertebral disc calcifications in an 8-year-old boy: case report and review of the literature. Eur J Pediatr. 2010	✓	✓																	-
Bhatia A et al.: Chronic pain in children in the UK: a survey of pain clinicians and	✓		✓																-

general practitioners. Paediatr Anaesth. 2008																		
Siebens HC. Musculoskeletal problems as comorbidities. Am J Phys Med Rehabil. 2007	-																	-
Quach C et al.: Group a streptococcus spinal epidural abscess during varicella. Pediatrics. 2002	✓		✓															-
John SD: Trends in pediatric emergency imaging. Radiol Clin North Am. 1999	✓	✓																-
Letts M et al.: The SAPHO syndrome in children: a rare cause of hyperostosis and osteitis. J Pediatr Orthop. 1999	✓	✓																-
Caselli MA et al.: Pedal manifestations of musculoskeletal disease in children. Clin Podiatr Med Surg. 1998	✓	✓																-
Swischuk LE: Musculoskeletal: what is different in children? Sliding on a slide, accident, lower extremity pain. Emerg Radiol. 2010	✓	✓																-
Brdar R, Petronic I, Abramovic D, Nikolic D, Cirovic D. Orthopaedic patterns of retroperitoneal tumors in pediatric population. Bratisl Lek Listy.	✓		✓															-

2009																			
<i>Ali S et al.: Pain management of musculoskeletal injuries in children: current state and future directions. Pediatr Emerg Care. 2010</i>	√	√																	-
<i>Zetaruk MN: The young gymnast. Clin Sports Med. 2000</i>	√	√																	-
<i>Kelly AM and Pappas AM: Shoulder and elbow injuries and painful syndromes. Adolesc Med. 1998</i>	√	√																	-
<i>Alwattar BJ et al.: Streptococcal toxic shock syndrome presenting as septic knee arthritis in a 5-year-old child. J Pediatr Orthop. 2008</i>	√		√																-
<b>Number of full text articles evaluated</b>	<b>112</b>																		
<b>Number of full text articles excluded</b>	<b>34</b>																		
<b>Total number of full-text articles included in qualitative synthesis</b>	<b>78</b>																		

**Abbreviations and symbols:** MSP: musculoskeletal pain; DD: differential diagnosis of musculoskeletal pain; √: yes; -: no; \* (review article): unless otherwise indicated by "√<sup>h</sup>", review provides information on all aspects of pediatric musculoskeletal pain addressed in the table