

BMJ Open Health literacy and musculoskeletal disorders in adolescents: a scoping review

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ABSTRACT

Objectives Health literacy (HL) related to musculoskeletal disorders (MSDs) in adolescents is a field with limited previous evidence. This study aimed to review and synthesise studies on MSDs and HL as well as various dimensions of HL in adolescents.

Design Scoping review in accordance with Arksey and O'Malleys framework and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews.

Search strategy The search strategy was performed in the following databases in November 2021 (initial search) and December 2022 (updated search); Medline, EMBASE, PsychINFO, Cochrane, CINAHL, ERIC, Web of Science and Google Scholar. Eligible studies involving MSDs and HL or either of the HL dimensions related to finding, understanding, appraising or applying health information in adolescents were considered. Any dimension of HL studied, the outcome measure(s) used to assess HL and the type of MSD examined were charted, reviewed and synthesised. A directed content analysis was used for the subjective interpretation of text data.

Results A total of 16 841 studies were identified and 33 were eligible for inclusion. Ten articles presented HL with a definition or description in the theoretical background. The remaining 23 studies involved finding, understanding, appraising or applying health information, without using the term 'health literacy'. Most of the studies addressed how adolescents *understand* (n=32), and *apply* (n=23) health information, while few studies focused on how they *find* (n=11) and *appraise* (n=7) musculoskeletal health information.

Conclusion Few studies have addressed HL and MSDs in adolescents explicitly, while most studies have considered dimensions of HL. Our findings suggest that there is important work to be done to align conceptual understandings with the measurement of HL in adolescents and that further research should be carried out to explore how HL is distributed among adolescents with MSDs and how adolescents living with MSDs report their HL.

INTRODUCTION

Musculoskeletal disorders (MSDs) are responsible for a substantial disability burden over the life course and consume considerable healthcare resources.¹ MSDs in adults have

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This is the first study reviewing and synthesising research on HL and MSDs in adolescents.
- ⇒ We applied the Arksey and O'Malley framework to screen and examine existing research.
- ⇒ We performed a directed content analysis with predefined codes derived from an established HL model.
- ⇒ We included studies that reported on how adolescents find, understand, appraise or apply health information, without referring to HL explicitly, and thus we had to rely on our judgement of whether the study had sufficient overlap with the dimensions of HL.

been the subject to great research efforts in recent last decades, but clinical research on MSDs in adolescents is still sparse.^{2,3} However, there is emerging evidence showing that MSDs are common among adolescents, and those suffering from them report a major impact on several areas of daily living, including less participation in leisure activities, more school absences, a restricted social life and a lower health-related quality of life.⁴⁻⁶ Such disorders are also common reasons for care seeking among adolescents, especially in primary healthcare settings.¹ MSDs tend to co-occur with other conditions, such as headache and depression, and they are associated with stress and worry.⁷ Importantly, MSDs experienced at a young age tend to persist into adulthood.⁸ Thus, attempts to understand ways to promote musculoskeletal health, prevent disorders or cope with these conditions soon after their initial onset are crucial.

Health literacy (HL) is a topic of growing importance in public health research and reflects the capacities of individuals to meet the complex demands of health in a modern society.⁹ Variation exists in the scientific community regarding the conceptual understanding of HL and its terminology, leading



to different interpretations of the concept in health and medical research.¹⁰ In the present context, HL is understood as follows: People's knowledge, motivation, and competencies to access, understand, appraise and apply health information in everyday life concerning healthcare, disease prevention, and health promotion to maintain or improve quality of life during the life course.¹¹

Improving both individual and societal levels of HL require understanding and lowering the barriers to information created by healthcare systems. Thus, it has been suggested that it is useful to view HL as a set of 'distributed competencies', which emphasises the HL abilities, skills and practices of others that contribute to an individual's HL.¹² This can be found dispersed through the individual's social network, rather than as an exclusively individual attribute.¹² It is important to acknowledge that adolescents are especially dependent on their parents or caregivers to have access to material, financial and social resources (eg, healthcare), which in turn may affect the adolescents HL. However, this is also the period of life when most individuals become more self-confident and independent, involving great changes socially and academically. This transitional stage between childhood and adulthood can be vulnerable and entails taking more responsibilities for one's own life and health in various settings.^{13 14}

Previous studies have shown that inadequate HL is associated with worse health outcomes, higher healthcare use and higher expenditure.¹⁵ Although pain and disease management require that individuals make decisions and undertake tasks that involve literacy skills, research specifically investigating MSDs and HL is scarce. During adolescence, fundamental cognitive, physical and emotional developmental processes take place and health behaviour develops, making young people a target group for HL research.^{16 17} The shift from being a passive recipient of care and information to an active participant in one's health and healthcare places expectations on adolescents to actively self-manage the day-to-day care of their own health.¹⁸ Hence, targeting adolescents with HL interventions may promote healthy behaviour, well-being and limit future health risks.¹⁷ Although HL in adolescents has received increased attention in the health professions literature, the number of studies is limited compared with studies on adults. Thus, there is a great need to review the extent and range of research in adolescents' HL related to musculoskeletal health.¹⁹ The aim of this scoping review is to review and synthesise all types of studies on MSDs and HL as well as dimensions of HL (ie, finding, understanding, appraising, applying) in adolescents.

METHODS

Design and reporting

Initial searches found no systematic or scoping reviews investigating HL among adolescents within the context of musculoskeletal health, pain or disorders. This review was conducted using Arksey and O'Malley's framework

for scoping reviews,²⁰ following their five steps: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; (5) collating, summarising and reporting the results. The steps are enhanced by contemporary recommendations,^{21 22} but without including the consultation exercise (stage 6), which is not mandatory.²⁰ The study design allows the examination of existing research, identification of research gaps and targeting of important areas for future research.²⁰ The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines and checklist (online supplemental appendix 1) were used in the search process and to guide reporting.^{22 23} A priori registration was published in the Open Science Framework preregistrations to enhance replicability and transparency and reduce any publication or reporting bias.²⁴ In line with the framework of Arksey and O'Malley²⁰ and the PRISMA-ScR checklist²³ the methodological quality of the included studies has not been appraised, as we have included studies with various methodological designs.

Search strategy

Systematic literature searches were conducted in collaboration with the University Library Literature Search Group at Oslo Metropolitan University (OsloMet). One initial (November 2021) and one updated (December 2022) search were performed in the following databases: Medical Literature Analysis and Retrieval System Online (Medline), Excerpta Medica database (EMBASE), PsycINFO, Cochrane Library, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Education Resources Information Center (ERIC), Web of Science and Google Scholar. Terms related to HL and MSDs in adolescents were identified for each database using a variety of subject headings, keywords and synonyms for 'adolescents' (10–19 years of age), 'musculoskeletal disorders' and 'health literacy'. We used the definition from Sørensen *et al*¹¹ as an overall framework and searched for 'health literacy' or any of its dimensions related to finding, understanding, appraising or applying health information regarding musculoskeletal health. Terms related to health education, health communication within healthcare services to improve health behaviour, health knowledge and health attitudes related to musculoskeletal health in adolescents were also adopted. The searches were conducted with no restrictions on publication dates up to December 2022 and are described in online supplemental appendix 2. All identified publications were imported into Covidence, a web-based software platform,²⁵ and duplicates were removed automatically and manually by the first author (SV). After de-duplication, of both the initial and the updated search 13 358 records remained for screening according to the eligibility criteria.²⁵

Eligibility criteria

All of the authors of this study participated in adjusting the eligibility criteria based on the population, concept and context tool.²⁶ The research team had a broad variety of experiences and preunderstandings related to the research topic. Relevant studies were included if they focused on the concept of HL or any of its dimensions related to musculoskeletal health or disorders. The target population was adolescents between 10 and 19 years of age, or those with an average age consistent with the age frame of 10–19 years for the total sample. This age range is in line with the WHO definition of adolescence.²⁷ First, the first author (SV) identified 22 studies from a random sample of 500 studies for discussion within the project group to clarify the criteria. Second, three of the authors (SV, KR, HJ) individually screened the titles and abstracts of 100 records, which yielded five conflicts. The final eligibility criteria were agreed on by all authors. Studies including people with specific underlying pathologies, such as tumours, infections, cardiovascular diseases, lung diseases, diabetes, diagnosed psychological diseases and inflammatory disorders with no connection to MSDs were excluded. All types of settings were considered for inclusion (ie, healthcare settings, prevention and health promotion settings). Full-length articles in the English or Scandinavian language were included. All types of study designs were considered for inclusion.

Data selection

Pairs of reviewers read all titles and abstracts. The first author screened the whole sample (n=13358), while three authors (HE, HJ and KR) examined the sample in three equal parts. Disagreements were initially resolved by discussions within the group and in pairs of two authors for the remaining conflicts. Articles meeting the inclusion criteria were obtained for further full-text reading and data synthesis. Full-text articles were read by all researchers in pairs (SV, HJ, MHA, HE, KR), and disagreements were resolved by discussing each article within the group. All authors hand-searched the reference lists of the included studies and the reference lists of previous systematic reviews and scoping reviews, which did not lead to the identification of new records.

Charting the data

A charting form with variables to extract was developed and pilot tested by each pair of researchers (online supplemental appendix 3). The first author extracted data from all the included studies. Further, the review pairs independently charted the data, discussed the results and continuously updated the data-charting form in an iterative process. After these adjustments were made, the following information was charted, if provided: author(s), publication date, country, study type, characteristics of the study populations, study aims, outcome measures, setting and results relevant for answering the scoping review question. Any definition(s) of HL adopted, dimensions of HL studied, the outcome measure(s) used

to assess HL and the type of musculoskeletal condition examined were also charted. Conflicts were solved within the research group.

Collation, analysis and summary

The first author (SV), in close cooperation with the last author (KR), conducted a directed content analysis to analyse, organise and synthesise the data.²⁸ This approach can provide predictions about the variables of interest or about the relationships among variables, as well as helping to determine the coding and the relationships between codes. This has been referred to as deductive category application.²⁸ There is no unified HL definition, however, most models include individual competencies like finding, understanding, appraising and applying health information.¹¹ Thus, we used these terms as predetermined codes in the analysis. A new code for *knowledge* was identified and added as a subcategory under 'understanding health information'. Codes were also developed according to the HL domains (healthcare, disease-preventing or disease-promoting settings). After the initial coding process, meaning units were selected and sorted before the content was abstracted and summarised in relation to the relationships between HL and MSDs. NVivo V.12 software was used to classify, sort and arrange the text in the analysis process. Any quantitative findings were transformed to qualitative text.²⁹ The results are presented visually in [table 1](#) to provide an overview of existing knowledge and current evidence alongside the descriptive themes from the directed content analysis (see online supplemental online supplemental appendix 4 for more detailed information about the studies). The studies are summarised by the type of study designs, MSD, HL domains, HL dimensions and the measures used. All the authors read the material to obtain an overall understanding of the data. The results were discussed among all the authors.

Patient and public involvement

No patient was involved.

RESULTS

A total of 16841 records were identified after an initial (n=14879) and updated search (n=1962) of eight databases. After removing duplicates 13358 records remained, of which 379 were read in full text. Finally, 33 studies were retained for this review ([figure 1](#)).

Research designs and study populations

Experimental studies (n=16) were the most prevalent, followed by cross-sectional (n=7), qualitative studies (n=7) and longitudinal/prospective (n=3) ([figure 2](#)). The studies were conducted in Europe (n=14), North America (n=10), Asia (n=7), Africa (n=1) and South America (n=1). Study populations varied across studies, including adolescents with mean age ranging from 11.3³⁰ to 19³¹ ([table 1](#)). Thirteen studies were conducted in a

Table 1 Characteristics of the selected studies (n=33)

Authors	Study design	MSD	Setting/ domain	Outcome measure	Definition HL	Dimension HL
Ahlgvist and Sällfors ⁴⁷	Qualitative, interview study	Low back pain	Healthcare	Experiences	-	Find Understand
Al-Zu'bi and Amayreh ⁴⁸	Cross-sectional study	Osteoporosis	Preventive	Osteoporosis knowledge and lifestyle	-	Find Understand
Anderson et al ⁴⁵	Cross-sectional study	Osteoporosis	Preventive	Osteoporosis Risk Factor Questionnaire, including components of knowledge and beliefs	-	Understand
Applebaum et al ⁴⁹	Qualitative, interview study	SLE, JIA	Healthcare	Brief Illness Perception Questionnaire, California healthy and ready to work transition healthcare guide. Experiences	-	Find Understand Apply
Bray et al ⁴⁰	Qualitative, interview study	Scoliosis	Healthcare	Experiences	'The cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health'	Find Understand Apply
El Miedany et al ⁶³	Randomised controlled trial	JIA	Healthcare	Adherence to therapy, school absenteeism and treatment outcomes. SDM aid was tested for its usefulness and friendliness using visual analogue scale	-	Understand Appraise
Foltran et al ⁶²	Non-randomised experimental study	Back pain	Preventive	Knowledge test: knowledge of spinal anatomy and physiology, adequate postures and furniture, and handling of school materials and other loads	-	Understand Apply
Geldhof et al ⁶¹	Non-randomised controlled study	Back pain/back posture	Preventive	Questionnaire on back posture knowledge and back function	-	Understand
Hazavehei et al ⁶⁰	Randomised controlled trial	Osteoporosis	Preventive	Questions organised by domains of HBM: knowledge, perceived threat, benefits, barriers, cues to action, healthy behaviour, actions for prevention	-	Understand Apply
Hutchinson and Hall ⁵⁰	Qualitative, interview study	Rheumatology (JIA, SLE)	Healthcare	Experiences	-	Find Understand
Iversen and Friden ⁶⁵	Pilot study of a prospective pre-post design	ACL injury	Preventive	Knowledge, attitudes and practices questionnaire about ACL injury techniques	-	Understand Apply
Jacobsson et al ⁶²	Cross-sectional study	Sport injuries	Preventive	Health literacy for School-Aged Children instrument (HLSAG)	A person's ability to understand, evaluate and use health information to promote health'	Understand Appraise Apply
Magee et al ⁴⁶	Non-randomised experimental study	Osteoporosis	Preventive	Osteoporosis knowledge test, Osteoporosis Self-efficacy Scale	-	Understand Appraise Apply
Blanco-Morales et al ⁵⁴	Qualitative, interview study	Back pain	Healthcare/ preventive	Experiences, field notes	-	Understand Apply

Continued

Table 1 Continued

Authors	Study design	MSD	Setting/ domain	Outcome measure	Definition HL	Dimension HL
Mendelson <i>et al</i> ⁵⁵	Prospective cohort study	JIA	Healthcare	Quiz on JIA, multiple-choice knowledge questions	–	Understand Apply
Minana-Signes <i>et al</i> ³⁰	Quasi-experimental study	Back health	Preventive	Nordic questionnaire. Back care knowledge, physical activities in daily life. Back care postural habits, physical activities in daily life	–	Understand Apply
Minghelli <i>et al</i> (2020) ³³	Non-randomised experimental study	Back health	Preventive	Theoretical test, multiple-choice questions. The practical test used was adapted from other studies and involved 5 tasks, 15 items to be evaluated	'Individual's ability to make informed decisions in various sectors, including home, work, community, and health services'	Understand Apply
Minghelli <i>et al</i> (2020) ³⁴	Quasi-experimental longitudinal	Back care	Preventive	Theoretical and practical test assessing ergonomic knowledge	'Cognitive and social skills and the ability of individuals to gain access to understand and use information in ways that promote and maintain good health'	Understand Apply
Minghelli <i>et al</i> (2021) ³⁵	Longitudinal	Postures and low back pain	Preventive	Theoretical test: LBP questionnaire	Improvement in ergonomic knowledge (literacy) of postures adopted at school and home due to the Back School and Postural Education programme	Find Understand Apply
Minghelli <i>et al</i> (2021) ³⁶	Longitudinal	Low back pain	Preventive	Theoretical test and practical test	Personal skills of teachers/ students, developing individual and collective health potential through increased literacy	Understand Apply
Lysenko <i>et al</i> ⁵¹	Pre-post experimental study	Diagnosed with scoliosis	Healthcare	Scoliosis Knowledge Questionnaire, Meaning of Illness questionnaire, The Adolescent Coping Orientation for Problem Experience	–	Find Understand Apply
Panahi <i>et al</i> ³⁷	Cross-sectional study	Osteoporosis	Preventive	Demographic and background characteristics. The Health Literacy Measure in Adolescent's questionnaire (HELMA)	'Cognitive and social skill that determines the motivation and ability of individuals to access, understand, and use information in a way that leads to maintaining and improving their health'	Find Understand Apply
Park and Kim ⁵⁶	Non-randomised experimental study	Spinal health	Preventive	Knowledge and practice test regarding spinal health related to the spinal health programme. Self-efficacy in the ability to promote spinal health	–	Understand Apply
Rastgoo <i>et al</i> ⁵⁷	Randomised controlled trial	Osteoporosis	Preventive	BASNEF model questionnaire: knowledge about osteoporosis prevention including 15 items	–	Understand Apply
Reiser <i>et al</i> ³⁸	Non-randomised experimental study	Rheumatic diseases/JIA	Healthcare	Disease knowledge: self-efficacy. Health-related quality of life (HRQoL), KINDL questionnaire (KINDL-R)	'Pictorial information can be helpful for young patients and for individuals with low (health) literacy ...'	Understand Apply
Schrader <i>et al</i> ⁵⁸	Non-randomised experimental study	Osteoporosis	Preventive	Osteoporosis Knowledge Questions	–	Understand Apply

Continued

Table 1 Continued

Authors	Study design	MSD	Setting/ domain	Outcome measure	Definition HL	Dimension HL
Lazaroff <i>et al</i> ⁶¹	Cross-sectional study	Rheumatic diseases. 70% had JIA	Preventive	Short Test of Fundamental Health Literacy (sTOFHLA), Transition Readiness Assessment Questionnaire, Objective Numeracy Scale, Subjective Numeracy Scale	'Capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions'	Understand
Springett and Wise ⁶⁴	Non-randomised experimental study	Back health	Preventive	A student evaluation form designed to evaluate the effectiveness of the Think Back Think Ahead Programme	-	Understand Appraise Apply
Stinson <i>et al</i> ⁴⁴	Qualitative interview study	JIA	Healthcare	Experiences	-	Find Understand Appraise Apply
Su <i>et al</i> ³⁹	Cross-sectional study	MSD (treated for sports-related injury)	Healthcare	Developed questionnaire, focused on measures of self-reported general HL, self-reported musculoskeletal HL and directly assessed musculoskeletal HL	'The ability to obtain, process, or understand basic health information needed to make appropriate health care decisions.' (USDHHS)	Understand Appraise
Schwieger <i>et al</i> ⁵²	Qualitative, document analysis	Scoliosis (brace treatment and no treatment)	Healthcare	Categories and subcategories for seeking or providing illness-related information	-	Find Understand
van Pelt <i>et al</i> ⁶³	Cross-sectional study	JIA	Healthcare	A questionnaire was developed similar to the questionnaire evaluating the frequency of HRI site use in patients. Clinical assessment, disease activity, psychological assessment (youth self-report, coping)	-	Find
Zarshenas <i>et al</i> ⁵⁹	Randomised controlled trial	Osteoporosis	Preventive	The Healthy Bones Knowledge Questionnaire, Osteoporosis Self-efficacy Scale	-	Understand Apply

ACL, Anterior cruciate ligament; AIS, Adolescent idiopathic scoliosis; HBM, Health belief model; HL, Health literacy; HRI, Health-related internet; JIA, Juvenile idiopathic arthritis; LBP, Low back pain; MSD, musculoskeletal disorder; S-DM, S-S-DM, Self-decision making; SLE, Systemic lupus erythematosus.

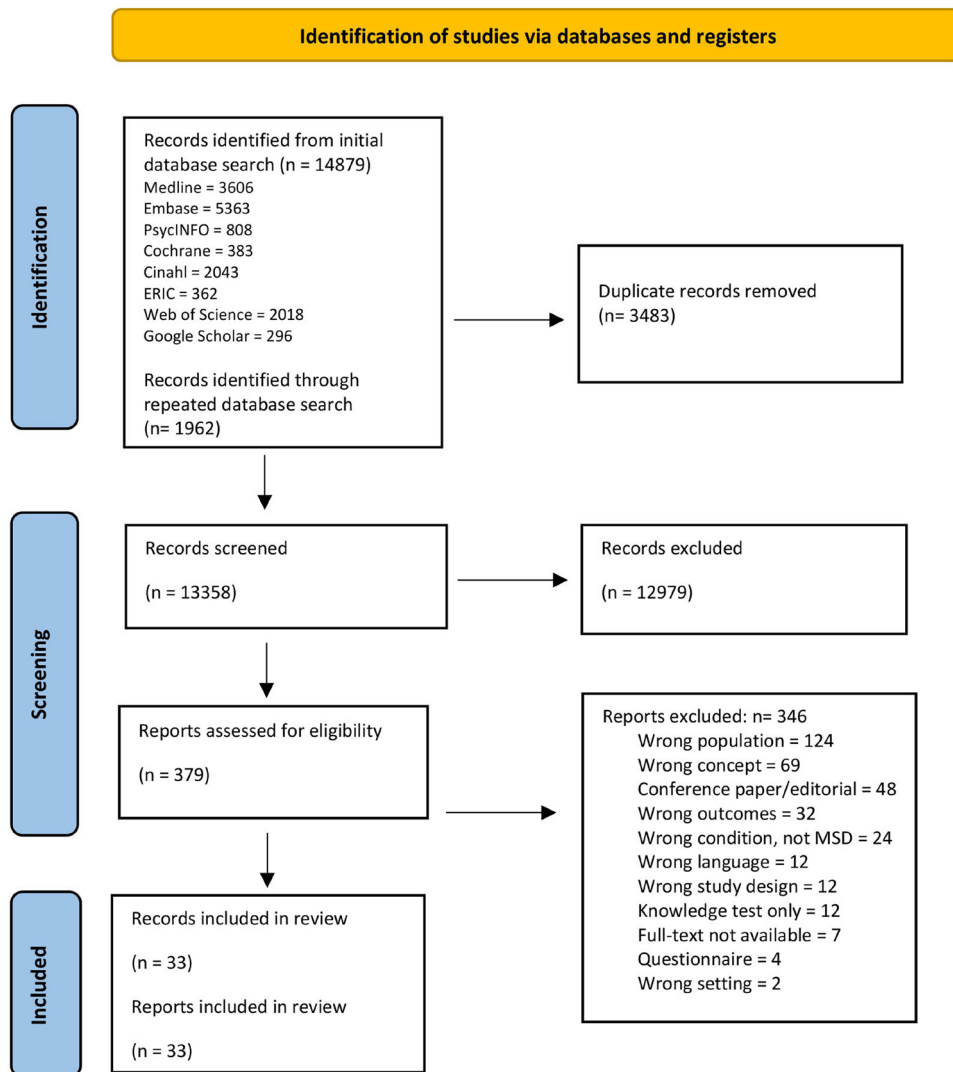


Figure 1 Flow chart illustrating the total number of records retrieved from eight databases and the relevance screening process.

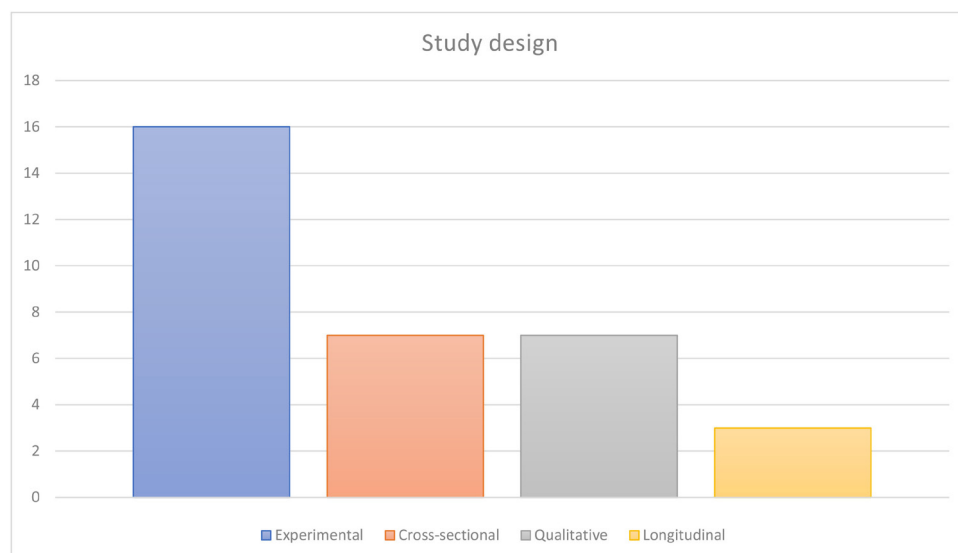


Figure 2 Overview of the study designs of the included studies.



healthcare setting targeting patients diagnosed with MSDs. The conditions included juvenile idiopathic arthritis (n=8), scoliosis (n=3) and back pain (n=2). The remaining studies (n=20) were carried out in a preventive sport or school setting, targeting preventive initiatives related to MSDs, such as back health (n=9), osteoporosis (n=8), and sports injuries (n=3) (table 1).

Descriptions of HL

Ten studies mentioned or presented definitions explicitly related to HL.^{31–40} The definitions of the WHO,⁴¹ Nutbeam,⁴² and the US Department of Health and Human Services⁴³ were used to present HL as an overall framework. Of these, two studies referred to both the WHO and Nutbeam; however, the definition was not in line with either of the original definitions.^{33 34} Three studies mentioned HL without using any definition or reference.^{35 36 38} The remaining studies involved dimensions of HL, such as finding, understanding, appraising or applying health information, but without using the term ‘health literacy’. As shown in table 1, two studies^{37 44} addressed information on all four HL dimensions. One of these studies presented HL as a framework, and the other used terms such as self-management, self-efficacy and coping. *Understanding* health information was the most frequently represented dimension in the included studies, followed by *applying*, *finding* and *appraising* health information.

Three studies used generic HL questionnaires: Health Literacy Measure for Adolescents (HELMA), Short Test of Fundamental Health Literacy and The Health Literacy for School-Aged Children (HLSAC).^{31 32 37} Thirteen studies used knowledge questionnaires developed for the purpose of the study, for example, true/false questions pertaining to knowledge regarding osteoporosis lifestyle risk factors.⁴⁵ Eight studies used patient-specific knowledge questionnaires that addressed one specific diagnosis (eg, Osteoporosis Knowledge Test and Osteoporosis Self-efficacy Scale).⁴⁶

Finding information

Eleven studies explored finding and accessing musculoskeletal health-related information.^{35 37 40 44 47–53} Among these studies, qualitative approaches were the most frequent design. Four studies used questionnaires to measure access to health information.^{37 48 52 53} These studies varied between *what* kind of information adolescents searched, *where* they searched and *when* they searched for health information. A recurrent finding was that adolescents primarily seek information from human resources, such as parents and healthcare professionals (HCPs). Family and friends were reported as an important source of information in four studies.^{40 44 48 50} Information was also sought from general practitioners, physiotherapists and school nurses.^{44 47 49 50} In many of the studies, HCPs were described as providers of reliable information for adolescents seeking to take a more active role in their own care. One study highlighted that the

adolescents trusted the information they received from HCPs, which gave them a greater understanding of and knowledge about how to mobilise their own resources.⁴⁷

Nine studies reported that adolescents searched the internet for musculoskeletal health information,^{40 44 47–53} but only four of these elaborated on what kind of information the adolescents searched for. All four studies included participants with an MSD, such as low back pain, juvenile idiopathic arthritis or scoliosis. The adolescents searched for facts about their disorder related to, for example, causes, progression, pain and functioning.^{47 52 53} One study found that the adolescents sought significantly more information when they were recently diagnosed compared with later in their disease trajectory,⁵² while another reported that graphic pictures of surgery made adolescents feel anxious.⁴⁰

Understanding and knowledge

In this scoping review, 32 studies included information about adolescents’ understanding of and knowledge about musculoskeletal health information. Some of the qualitative studies focused on the target groups’ experiences in understanding health information provided by healthcare personnel.^{40 44 47 50 54} For example, one study focused on adolescents’ understanding of information about scoliosis during a consultation.⁴⁰ They described a feeling of being part of the consultation, although they did not understand all the clinical words being used. This often resulted in consultations being dominated by their parents.⁴⁰ The intervention studies often proposed health information through theoretical and/or practical or skill-based presentations, including various topics related to MSDs.^{30 33–36 38 46 51 55–62} Sessions varied between learning about anatomy, risk factors, prevention techniques, workshops with practical ergonomic exercises, comic books explaining disease-related information and benefits of treatment. After receiving information through oral or written presentations, the adolescents’ knowledge level was tested for the specific topic.

Appraising information

Seven studies investigated adolescents’ appraisal and critical evaluation of health information.^{32 37 39 44 46 63 64} Two studies included questionnaires asking questions about the adolescents’ ability to judge health information and critical thinking (HELMA+HLSAC)^{32 37}; however, these instruments give total HL scores only. Two studies addressed adolescents’ confidence in making decisions after receiving information about MSDs.^{39 46} This was measured by asking the adolescents how confident they were when filling out medical forms on their own. According to two of the qualitative studies, adolescents felt that websites could enable the delivery of trustworthy and current information.^{44 53} However, another study reported on how adolescents worried about the quality of internet-based information on rheumatological conditions.⁴⁹

Applying information

Twenty-three studies reported how adolescents use health information. Across studies, understanding health information is often seen in combination with how the adolescents report or demonstrate that they apply health information. In these studies, the adolescents' level of knowledge was tested not only to see if they understood the presented information but also to determine if they were able to make use of the information. Five studies *observed* how adolescents applied health-related information. This was either measured by practical tests, where adolescents performed an ergonomic task according to correct position/exercises, or by videotaping exercises or movements.^{33–36 65}

Fourteen studies used self-reported questionnaires to measure how adolescents consider changes in their health behaviour.^{30 32 37 38 46 48 49 55–60 65} For example, one study showed improved self-efficacy scores, as the adolescents expressed confidence that they would change their exercise habits after receiving health-related information.⁴⁶ Another study used a self-reported questionnaire, including items focusing on spinal health-related practice and whether they had adopted the postures and body mechanisms presented during the intervention.⁵⁶

DISCUSSION

This scoping review provides insight on the extent and content of research across different settings on how adolescents find, understand, appraise and/or apply health information related to musculoskeletal health and disorders. Although several of the studies presented data on adolescents' handling of health information, only a few mentioned or described HL in the theoretical background and applied an instrument to measure HL. Among the studies that did include HL as a concept, there was a lack of correspondence between definitions and measures. The definitions presented had a broad perspective on HL, while the instruments that were used mainly measured basic skills and knowledge about MSDs.

Several previous reviews have also reported on a diversity of understandings of HL and the various use of instruments not aligned with the definitions in current research.^{66–70} This characterises HL research in general and is not necessarily unique to adolescent research.⁶⁶ Three HL instruments were identified in the present review, two of which were developed specifically for young people. The majority of studies in this scoping review presented data on finding, understanding, appraising or applying health information, but without referring to HL. Similar to the studies using the term 'health literacy' explicitly and applying instruments to measure it, the remaining studies argued for the importance of ensuring that adolescents can comprehend health information, navigate the health service, interact with health personnel, manage their disease, follow-up on treatment and take care of their own musculoskeletal health. This may highlight the need for a clarification of HL

definitions.⁶⁶ However, it is important to acknowledge that HL is still a relatively new and evolving concept in health research, in adolescent health and in musculoskeletal health. Thus, we argue that the included studies add important information related to the aim of this review.

This review shows that there is limited research on how adolescents *find* and particularly on how they *appraise* health information regarding MSDs. Among the studies that presented data on finding health information, some showed that young people rely on their parents and health professionals as important resources in obtaining musculoskeletal information. This highlights that adolescents' family and social network remains an important source of health information and may reflect how HL appears as a distributed competency.¹² Nevertheless, with interactive and communication technologies now emerging, the internet has become one of the main health information resources for adolescents.⁷¹ Internet content is not regulated, and the information that is available varies enormously in quality, leading to confusion and misinformation.^{72 73} The studies included in this review did not present data on digital HL specifically. However, the use of the internet was found to be an important source of information in some of the studies. Thus, our findings may emphasise an important knowledge gap in the existing research field, specifically the small amount of research that has actually focused on adolescent's critical appraisal of MSD information.

Particularly evident in our findings was the emphasis on adolescents' *understanding* of musculoskeletal health information or their *health knowledge* measured through knowledge tests. Health knowledge is strongly linked to HL, and it refers to the facts, information, and skills acquired through experience or education as well as the theoretical or practical understanding of a subject related to health and healthcare.^{74 75} Previous studies have demonstrated that health knowledge plays an important role in HL research, although its exact position varies across studies. In the included studies, it was frequently linked to adolescents' *understanding* of health information, and thus it may be seen as a type of declarative health knowledge that often concerns factual knowledge related to health issues.⁷⁵ In contrast, the integrated model of Sørensen *et al*¹¹ state that knowledge, motivation and competencies are integral parts of comprehensive HL.¹¹ Clarifying the role of health knowledge could help to structure the many HL theories and provide a better understanding of HL in order to improve HL and health outcomes.

The literature argues that the generic HL of adolescents must be improved to enable a better transfer of competencies into adulthood.⁷⁶ Targeting HL in its entirety has clear implications for healthcare and prevention settings. It is essential that preventive initiatives and treatments are designed in alignment with adolescents' developmental stage and meet their specific needs.⁷⁷ Few studies included in this scoping review applied a qualitative approach when investigating HL and MSDs in adolescents. Therefore,



more in-depth qualitative exploration of how adolescents make meaning of health information related to MSDs is warranted. Additionally, studies must move beyond functional HL to understand the capacity of adolescents to find, evaluate and apply MSD health information. Adolescents' own perspectives are key to the development of interventions, and thus a participatory approach should be applied when developing educational programmes. User involvement was not particularly evident in our findings. However, this was not information we intended to address in this scoping review.

The studies included in this review targeted both patients within the healthcare system diagnosed with MSDs and general adolescent samples approached in preventive settings. A significant proportion of the adolescent population will experience periods of musculoskeletal pain and in some cases develop specific disorders. Thus, developing HL skills to promote musculoskeletal health and prevent and manage disorders is essential. All studies aiming to increase knowledge to prevent MSDs (eg, back pain and osteoporosis) were carried out in a school setting, which is strongly supported by the WHO's framework for health-prevention and health-promoting schools.⁷⁸ The studies included in this review highlight that a focus on education within the musculoskeletal field is essential for preventing MSDs and reducing educational and health disparities. However, health education should be more than providing knowledge. It should also include skills such as finding, evaluating and integrating credible health information in various contexts, communicating and applying health information, as well as acting with confidence in a health-related setting.⁷⁶

Strengths and limitations

A limitation of this study is the use of an HL framework for structuring the findings that was not developed for young people. Adolescents constitute a core target group in HL research and practice because essential health behaviours are formed early in life. There is limited consensus regarding the abilities and knowledge adolescents should possess to make sound health decisions. There have been attempts to develop HL definitions and frameworks aimed at young people.¹⁷ These definitions and models are very heterogeneous, depicting HL as a complex construct, but they are also fairly similar to the ones identified for adults, including that of Sørensen *et al.*^{11 17} We chose to apply Sørensen's model because it combines the qualities of a conceptual model, outlining the most comprehensive dimensions of HL and showing the proximal and distal factors that impact HL as well as the pathways linking HL to health outcomes. Consequently, information relevant to adolescents, such as contextual factors and the impact of the intermediate environment on the target population, may have been omitted. This is the first scoping review to summarise the scientific literature on HL and MSDs in adolescents. As HL is a multidimensional concept, we applied a broad search strategy, purposefully including variants of 'health

knowledge' and 'health education' as key terms and studies that did not refer specifically to the concept of 'health literacy'. In this way, we were able to capture studies focusing on HL both explicitly and implicitly. Thus, the inclusion of articles was based on our judgement of whether the study had sufficient overlap with HL or dimensions of HL, as defined by the model of Sørensen *et al.*¹¹ A strength of this review is the use of a directed content analysis for the subjective interpretation of the complex content of text data.²⁸ This deductive approach allowed a systematic classification of the coded themes. When prior research exists about a phenomenon that would benefit from further description, directed content analysis is a suitable approach.²⁸ Moreover, the framework of Arksey and O'Malley, is useful for mapping the field of research when it is challenging to visualise the range of available material.²⁰

CONCLUSION

This scoping review analysed and synthesised studies on adolescents' HL or its dimensions relating to finding, understanding, appraising or applying information on MSDs. The studies were distributed equally in health-care and preventive settings. A large proportion of the included studies addressed how adolescents *understand* and *apply* health information, and most of the studies used knowledge tests to measure adolescents' understanding of MSD information. A smaller portion of the studies focused on how adolescents *find* and *appraise* musculoskeletal information. Few studies employed a clear definition of HL, and among the studies including a definition of HL there seemed to be inconsistency in the definitions and instruments used to measure the concept. The findings suggest that there is important work to be done to align conceptual understandings with the measurement of HL in adolescents. Further research should be carried out to explore how HL is distributed among adolescents with MSDs and how adolescents living with MSDs report their HL, particularly how they find and evaluate information about their condition. Such information has the potential to inform interventions to support adolescents in managing their own musculoskeletal health.

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