



LEEDS  
BECKETT  
UNIVERSITY

---

Citation:

Thompson, C and Milligan, J and Johnson, M and Briggs, M (2018) 25 years of pain education research - what have we learned? Findings from a comprehensive scoping review of research into pre-registration pain education for health professionals. *Pain*. ISSN 1872-6623 DOI: <https://doi.org/10.1097/j.pain.0000000000001352>

Link to Leeds Beckett Repository record:

<https://eprints.leedsbeckett.ac.uk/id/eprint/5323/>

Document Version:

Article (Accepted Version)

---

The aim of the Leeds Beckett Repository is to provide open access to our research, as required by funder policies and permitted by publishers and copyright law.

The Leeds Beckett repository holds a wide range of publications, each of which has been checked for copyright and the relevant embargo period has been applied by the Research Services team.

We operate on a standard take-down policy. If you are the author or publisher of an output and you would like it removed from the repository, please [contact us](#) and we will investigate on a case-by-case basis.

Each thesis in the repository has been cleared where necessary by the author for third party copyright. If you would like a thesis to be removed from the repository or believe there is an issue with copyright, please contact us on [openaccess@leedsbeckett.ac.uk](mailto:openaccess@leedsbeckett.ac.uk) and we will investigate on a case-by-case basis.

**Title** 25 years of pain education research – what have we learned?  
Findings from a comprehensive scoping review of research into pre-registration pain education for health professionals

**Authors** Thompson, Kate<sup>1</sup> Johnson, Mark I<sup>1</sup> Milligan, James<sup>1</sup> Briggs, Michelle<sup>2,3</sup>

**Affiliations** Centre for Pain Research, Portland Building, Leeds Beckett University, Leeds, UK<sup>1</sup>  
Division of Nursing, Midwifery and Social Work, School of Health Sciences, Faculty of Biology, Medicine and Health, University of Manchester, Manchester, Greater Manchester, UK<sup>2</sup>  
Research and Innovation Division, Central Manchester University Hospitals NHS Foundation Trust, Manchester, UK<sup>3</sup>

**No of text pages** 24

**No of figures/tables** 5

**Correspondence to** Kate Thompson, School of Clinical & Applied Sciences, Portland Building, Leeds Beckett University, Leeds, U.K  
[k.a.thompson@leedsbeckett.ac.uk](mailto:k.a.thompson@leedsbeckett.ac.uk)

1           **Title**                           25 years of pain education research – what have we learned?  
2   Findings from a comprehensive scoping review of research into pre-  
3   registration pain education for health professionals  
4  
5  
6  
7  
8           **Authors**                       Thompson, Kate<sup>1</sup> Johnson, Mark I<sup>1</sup> Milligan, James<sup>1</sup> Briggs, Michelle<sup>2,3</sup>  
9  
10           **Affiliations**                   Centre for Pain Research, Portland Building, Leeds Beckett University, Leeds,  
11   UK<sup>1</sup>  
12  
13   Division of Nursing, Midwifery and Social Work, School of Health Sciences,  
14   Faculty of Biology, Medicine and Health, University of Manchester,  
15   Manchester, Greater Manchester, UK<sup>2</sup>  
16  
17   Research and Innovation Division, Central Manchester University Hospitals  
18   NHS Foundation Trust, Manchester, UK<sup>3</sup>  
19  
20  
21  
22  
23  
24  
25           **No of text pages**           24  
26  
27  
28           **No of figures/tables**       5  
29  
30           **Correspondence to**       Kate Thompson, School of Clinical & Applied Sciences, Portland Building,  
31   Leeds Beckett University, Leeds, U.K  
32   [k.a.thompson@leedsbeckett.ac.uk](mailto:k.a.thompson@leedsbeckett.ac.uk)  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1  
2  
3 **ABSTRACT**  
4  
5  
6

7 The International Association for the Study of Pain (IASP) have designated 2018 as the global year for  
8 excellence in pain education. Despite advances in pain research, there remains an inadequate  
9 understanding and implementation of pain education that health professionals obtain in training  
10 prior to professional registration, licensure or certification. This paper reports on a synthesis of pain  
11 education research that has been conducted in this period of health professionals training. A scoping  
12 review framework by Arksey and O'Malley was used to guide a search of medical and education  
13 databases for records that have examined or evaluated pain education. Fifty-six reports were  
14 identified representing sixteen professions across twenty nine countries, published between 1992-  
15 2017. A descriptive account of the reports is provided which includes a timeline, geography,  
16 methods of evaluating and main purpose of the research. A narrative synthesis was undertaken to  
17 summarise and explain the results and main findings from reports of studies included in this review.  
18 Further to this a concept analysis was conducted to identify and map key concepts that can be used  
19 by stakeholders to develop or evaluate future pain education. Future directions for research are  
20 proposed which includes factors that are repeatedly reported to be important in advancing pain  
21 education and should underpin the campaign for environments that promote excellence in pain  
22 practice as the norm in healthcare.  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38

39 **1. INTRODUCTION**  
40  
41

42 The International Association for the Study of Pain (IASP) Council have designated 2018 as the global  
43 year for excellence in pain education. Pain is recognised as a global health problem with significant  
44 impact on health and social care systems [15; 29; 40; 58; 76] . In response to this global crisis a  
45 number of countries produced national pain strategies or action plans which IASP analysed to  
46 produce 'Desirable Characteristics of National Pain Strategies: Recommendations by the  
47 International Association for the Study of Pain' [6]. Access to pain education for health professionals  
48 is one of the key recommendations to improve pain care, specifically that trainees are equipped with  
49 both the knowledge and skills to address all types of pain at an early stage of training. This is  
50 consistent with the Declaration of Montreal which states one of the reasons that pain management  
51  
52  
53  
54  
55  
56  
57  
58

1 is inadequate in most of the world is because there are major deficits in knowledge of health care  
2 professionals regarding the mechanisms and management of pain [1; 2]  
3  
4

5  
6 Advancing pain education is complex because the range of knowledge and skills that a practitioner  
7 requires to be competent in pain management is broad and varied and the subject may be taught  
8 and evaluated from both a theoretical and practical aspect. Hence, pain education needs to include a  
9 variety of pedagogic approaches to facilitate learning including comprehension, interpretation,  
10 analysis and evaluation of knowledge and competence of practical skills. Despite the challenges  
11 there has been an increase in pain education research over recent years, however it remains unclear  
12 how pain education has progressed in terms of improving patient care.  
13  
14  
15  
16  
17  
18

19  
20 Problems with pain education identified by surveys of multiple health science courses in higher  
21 education institutions across the USA, Canada and Europe include a lack of dedicated curriculum  
22 time, and that pedagogic approaches are thought to be ineffective in improving students pain  
23 knowledge and skills. Pedagogic approaches tend to be didactic and biomedically focussed which  
24 may not be optimal for developing knowledge and skills relevant to a pain practitioner [17; 22; 45;  
25 79]. The Institute of Medicine (IOM) Report Relieving Pain in America identifies problems in pain  
26 education, but also provides a list of recommendations to improve curriculum and education for  
27 health care professionals [3].  
28  
29  
30  
31  
32  
33  
34  
35

36 We conducted a rapid scope of medical and education databases which revealed a large number of  
37 published reports of evaluations of pain education using a range of research methodologies.  
38 However, we did not find any reviews or syntheses of this research literature. The aim of this review  
39 is to scope the nature and synthesise the findings of research that has evaluated pain education for  
40 pre-registration/pre-licensure health professionals. A timeline of published reports will be provided,  
41 along with a synthesis of results and main findings, and an analysis of concepts that are key to the  
42 development and evaluation of pain education.  
43  
44  
45  
46  
47  
48  
49

50 The findings presented in this manuscript formed part of a larger scoping review that examined both  
51 research and policy for pain education. The format of the review was informed by a conceptual  
52 framework which is available in the published protocol [71]. The methodology to identify reports  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 from medical and education databases, and findings from the review of research are presented in  
2 this manuscript. The findings from the review of policy are published elsewhere [70].  
3  
4  
5

## 6 **2. METHODS**

7  
8  
9 A scoping review methodology was used to determine the breadth and depth of pain education  
10 literature which is briefly described in sections 2.1 to 2.5 of this manuscript [13].  
11  
12

### 13 **2.1. Stage 1: Identifying the research question**

14  
15 One researcher (KT) conducted preliminary searches in Medline to pilot the search terms relevant to  
16 pain education research. A number of references were retrieved relevant to the examination or  
17 evaluation of pain education. These were subsequently discussed amongst the review team at which  
18 point the research question and search strategy were refined. Broad search terms were used to  
19 capture a wide variety of records and maintain breadth of coverage. Search terms were narrowed  
20 once a sense had been gained of the volume and scope of the literature.  
21  
22  
23  
24  
25  
26  
27  
28

### 29 **2.2. Stage 2: Identifying relevant studies**

30  
31  
32 An iterative approach was taken where the search strategy was revised with increasing familiarity  
33 with the literature and feedback from peer review. To locate reports that have examined or  
34 evaluated pain education search terms were combined using Boolean operators e.g. [pain] AND  
35 [curriculum OR education] AND [allied health occupations OR medicine OR nursing] in the following  
36 medical and education databases; MEDLINE, CINAHL, HMIC, AMED, EBM reviews and ERIC. Exploded  
37 MeSH or thesaurus search terms were used where possible along with keyword searches [pain  
38 education] OR [pain curriculum]. Subsequently reference lists of key papers were hand searched to  
39 identify any further relevant papers.  
40  
41  
42  
43  
44  
45  
46  
47  
48

### 49 **2.3. Stage 3: Study selection**

50 The search strategy revealed a large number of citations (>3500) which were independently  
51 screened for eligibility by two authors (KT & JM). A third reviewer (MB) acted as arbiter where  
52 agreement could not be reached. The initial eligibility criteria was purposely broad to determine  
53 breadth of coverage. The eligibility criteria were; i) published in the English language, ii) directly  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 relevant to the pre-registration/pre-licensure pain curriculum (i.e. nursing, medicine, allied health  
2 professions), iii) human participants, iv) extractable data, iv) no date restriction.  
3  
4

5  
6 Following the iterative nature of the methodology additional exclusion criteria were added after the  
7 first round of screening. Reports were excluded if i) they were not categorised as research in its  
8 broadest sense e.g. editorials/commentaries/opinion papers/letters to editors were excluded, ii)  
9 reports focussed on one specific health condition e.g. surgical/cardiac/cancer pain, iii) paediatric  
10 pain, and iv) published more than twenty five years ago. Reports that focussed on pain located to  
11 one area of the body e.g. chronic low back pain were included under the umbrella musculoskeletal  
12 pain. These exclusions were applied to maintain a broad approach to pain education that was not  
13 focussed to one patient group, and therefore the results would be applicable across the professions.  
14 The full text of all papers deemed eligible on title and abstract screening were put through to stage 4  
15 of the review.  
16  
17  
18  
19  
20  
21  
22

#### 23 **2.4. Stage 4: Charting the data**

24  
25 Author, year of publication, report location, type of report, health profession, purpose, methods of  
26 evaluating pain education, and main findings were extracted and charted by one author (KT). Any  
27 papers where data charting or eligibility were unclear were reviewed by another review team  
28 member (JM).  
29  
30  
31  
32  
33  
34  
35  
36  
37

#### 38 **2.5. Stage 5: Collating, summarising and reporting the data**

39 Results were collated and analysed in the following way.  
40  
41

- 42 i. A descriptive account providing the type, number, year of publication, location, methods  
43 of evaluating and the main purpose of pain education research.
- 44 ii. A narrative synthesis of key findings by research reports.
- 45 iii. An analysis of key concepts central to the design and evaluation of pain education.  
46  
47  
48  
49  
50  
51

### 52 **3. RESULTS**

#### 53 **3.1. OUTCOME OF THE SEARCH AND SUBSEQUENT SCREENING**

54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 The number of records identified by the search strategy, subsequent screening, eligibility and  
2 inclusion in the review is demonstrated in figure 1.  
3

4  
5 < Insert figure 1. Here >  
6

### 7 3.2. DESCRIPTIVE ACCOUNT 8

9  
10 Fifty-six reports of studies were located across twenty-nine countries ranging from 1992-2017, with  
11 just over forty percent (23/56) located in the USA (Table 1).  
12

13  
14 Participants identified in reports include health students, higher education faculty staff (e.g.  
15 lecturers, program directors, board members), and clinical staff (including new graduates). Only one  
16 out of fifty six reports included patients as participants. Sixteen health professions were referred to  
17 with the majority of research conducted in medicine, nursing, physiotherapy, and occupational  
18 therapy.  
19  
20  
21  
22

23  
24 Scoping review methodology purposefully allows for a range of literature to be included in the  
25 review therefore the type of research in the reports identified and methods used to evaluate or  
26 examine pain education were varied and in some cases difficult to categorise where mixed  
27 methodology had been used.  
28  
29

30  
31 Survey methodology was the most frequent approach to examine or evaluate pain education,  
32 followed by observational/cohort studies, experimental designs, course evaluations, qualitative  
33 approaches, and document analysis. The main purpose of each report was documented and coded  
34 by one author (KT), with five major categories emerging;  
35  
36  
37

- 38 1. Analysis of student knowledge, skills, attitudes and beliefs regarding pain
- 39 2. Analysis of course curricula
- 40 3. Development of curricula
- 41 4. Evaluation & perception of education by faculty educators or students
- 42 5. Other factors reported to be relevant to pain education
- 43
- 44
- 45
- 46
- 47
- 48
- 49

50 Figure 2 demonstrates the timeline, geography, health profession, and main purpose of reports  
51 identified in each of these categories.  
52  
53

54  
55 < Insert figure 2 here >  
56  
57  
58



### 3.3. NARRATIVE SYNTHESIS

Understanding the results of large bodies of evidence is challenging when research uses a range of methods like those described in this scoping review. Hence, an approach to narrative synthesis described by the Cochrane Consumers and Communication Review Group was used to make sense of the results which summarise and explain findings primarily on the use of words rather than numerical results [63].

To provide initial structure to the narrative synthesis the results were analysed in the five categories described earlier by way of the main focus/purpose of the report. One author (KT) read the results of each study in their respective categories several times to identify key characteristics, similarities and differences between the results. These were reviewed and discussed until agreement was gained by all team members.

#### 3.3.1 Analysis of student knowledge, skills, attitudes and beliefs regarding pain

This review found that student knowledge, skills, attitudes and beliefs regarding pain have been investigated for over twenty-five years. These reports appear to have been conducted for one of two reasons;

- i) To examine or evaluate student knowledge, skill, attitude or beliefs regarding pain as a result of normal health curricula. In these reports students may have experienced pain education as part of their usual health training, but it was not reported as a focus within curricula.
- ii) To examine or evaluate student knowledge, skill, attitude or beliefs regarding pain as a result of curricula that overtly incorporates or identifies pain into education. This is often referred to in the literature as dedicated pain education.

Reports that analysed student knowledge, skills, attitudes or beliefs regarding pain as a result of normal curricula were found across medicine [8; 11; 18; 46; 50; 54], nursing [9; 10; 20; 21; 23; 30; 31; 55; 57; 65], physiotherapy [8; 11; 25; 62], and occupational therapy [60; 68]. These reports frequently found that students lacked knowledge and skills, and that many had negative attitudes and beliefs regarding pain as a result of normal health curricula. Of those that did demonstrate some improvement throughout the educational process, pain knowledge was still often reported to be suboptimal.

1 Reports that analysed student knowledge, skills, attitudes or beliefs regarding pain as a result of  
2 curricula that overtly identified or incorporated pain into education were found across medicine [12;  
3 53; 56; 66; 78; 81; 82], nursing [42; 78], physiotherapy [44; 67; 78], dentistry [78], occupational  
4 therapy [61; 67; 75; 78], and pharmacy [78]. Contrary to the results of the reports that evaluated  
5 normal curricula, these reports frequently found that pain knowledge, skill, attitudes and beliefs  
6 regarding pain significantly improve when students were exposed to this type of pain education.  
7

8  
9  
10  
11  
12 Approaches to dedicated pain education were varied. They included: an elective chronic pain course  
13 [12], e-learning [42; 56; 81], a 4-day pain course [53], brief clinical and pain science seminars [82], a  
14 curriculum based on IASP core curricula outlines [67; 78], other pain curricula [59; 66; 75], and a  
15 teaching module on chronic pain [44].  
16  
17

18  
19 A large number of studies reported the use of tools used to evaluate pain knowledge, skill, attitude  
20 or belief regarding pain, which included the Neurophysiology of Pain Questionnaire [8], the  
21 Knowledge and Attitudes Survey Regarding Pain (KASRP) [10; 20; 30; 42; 55; 57], the Revised  
22 Knowledge and Attitudes Survey Regarding Pain (RKASRP) [9; 23], the Schutte Emotional Intelligence  
23 Scale (SES) [20], Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS) [25; 44;  
24 50; 60; 62], Pain Attitudes and Beliefs Scale for Physiotherapists (PABS-PT) [11], 23-item Pain  
25 Knowledge Questionnaire [11; 21], City of Boston's Rehabilitation Professionals' Knowledge and  
26 Attitude Survey Regarding Pain (COBS) [61], Pain Knowledge and Attitude Questionnaire [75],  
27 Revised Pain Knowledge and Attitude Questionnaire [67; 68] and the Pain Knowledge and Beliefs  
28 Questionnaire [78].  
29  
30  
31  
32  
33  
34  
35  
36  
37

38 Other methods of evaluating pain knowledge, skill, attitude or belief included clinical vignettes [65],  
39 interviews [47; 68], multiple choice questions (MCQ's) [56], clinical skills exams or checklists [46; 66],  
40 computer simulated or virtual patients [36; 37], and written assessment portfolios or assignments  
41 [53]  
42  
43  
44  
45

### 46 **3.3.2. Analysis of curricula**

47  
48 This review also located studies that reported an analysis of the pain curricula across health  
49 professional courses by two distinct methodologies: i) faculty educators have been questioned about  
50 content and approaches, and ii) course curricula documents have been evaluated (table 1).  
51  
52  
53

54 Analysis of pain curricula by surveys of faculty educators were found across nursing [17; 19; 22; 30;  
55 45; 74; 79; 83] dentistry [17; 19; 22; 45; 79], medicine [17; 19; 22; 45], midwifery [17; 19],  
56  
57  
58

1 occupational therapy [17; 19; 45; 79], pharmacy [17; 19; 22; 45; 79], physiotherapy [17; 19; 34; 45;  
2 64; 79], veterinary science [17; 79], and social work [22].  
3

4  
5 Analysis of curricula by evaluation of written course curricula documents were found across  
6 medicine [16; 49; 80] dentistry [80], nursing [48; 80], pharmacy [80], occupational therapy [80],  
7 physiotherapy [80], psychology [80], and veterinary medicine [80].  
8  
9

10  
11 Analysis of the pain curricula within and across the health professions indicated that there were only  
12 minimal standards relating to pain education from health regulators and quality assurance  
13 documents [17]. Traditional teaching methods such as lectures were most frequently used to teach  
14 pain [17; 22], yet pain education was lacking in total number of taught hours and was variable within  
15 and across the health professions in the UK [17], USA [22], Canada [79; 80] and Norway [45]. IASP  
16 curricula were poorly integrated [17; 22] and there were a lack of entry to practice pain  
17 competencies [80].  
18  
19  
20  
21  
22

23  
24 Reports that analysed curricula from professions on an individual basis were found across medical  
25 curricula in Europe [16] and the USA [49], nurse curricula in the UK [47; 74] and USA [83], and  
26 physiotherapy curricula in the USA [34; 64]. Again substantial variation was found [16; 34; 49] often  
27 with investigators concluding that there was minimal pain content [47; 64; 74], and IASP core  
28 curriculum received little or no coverage [49].  
29  
30  
31  
32

33  
34 Qualitative methodology has been used to report the barriers and successes to implementing pain  
35 education with two major themes of successes and challenges emerging from the data. Successes  
36 included expanding pain education with a multidimensional curricula and teaching methods.  
37 Challenges include difficulties in identifying pain in the curricula, biomedical versus biopsychosocial  
38 definitions of pain, perceived importance, time, resources and staff knowledge, and responsibility  
39 for pain education [19].  
40  
41  
42  
43  
44  
45  
46  
47

### 48 **3.3.3. Development of curricula**

49  
50 A number of reports were identified by this review that described studies that aimed to advance  
51 curricula by developing inter-disciplinary outcomes or competencies for pain education [28; 51; 69;  
52 73]. These reports focussed on how curricula could or should be developed to improve graduates  
53 competence to practice pain management on graduation (table 1).  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 Recommendations for medical pain curricula were reported [51], along with curriculum content  
2 guidelines for educating medical students about the evaluation and management of chronic pain in  
3 older adults [73]. A comprehensive list of outcome based pain assessment and management  
4 competencies determined by interprofessional and international consensus building are available  
5 [28].  
6  
7  
8  
9

10 Only one report identified by this review included patients as participants. This report analysed  
11 qualitative data from patients, students and educators to identify gaps in pain management  
12 knowledge with five emergent themes making recommendations for medical curricula [69].  
13  
14  
15

#### 16 **3.3.4. Faculty staff and student perspective on pain education**

17 Faculty staff were reported to have variable satisfaction in relation to pain management in their  
18 courses [34; 64; 83].  
19  
20  
21  
22

23 Student evaluation of pain education was reported to be varied. Findings included reports of  
24 perceived gaps in knowledge and skills regarding pain in normal curriculum designs with some  
25 students reporting their pain education to be minimal [21]. Students also advocated the inclusion of  
26 additional pain teaching [68], and rated pain education highly in studies that report curricula with  
27 overt pain education [32; 53; 56; 78].  
28  
29  
30  
31

32 An electronic IASP questionnaire has been used by medical students to evaluate how the IASP pain  
33 curriculum had been covered during their studies [46].  
34  
35  
36  
37  
38

#### 39 **3.3.5. Other factors reported to be relevant in pain education**

40 The knowledge and attitudes, and previous experiences of nursing faculty are reported to be  
41 relevant and influential in pain education [23; 26; 30; 41; 77]. Other factors that are reported in the  
42 findings of studies that have examined or evaluated pain education include cultural differences in  
43 attitudes and beliefs about pain [25], emotional intelligence [20], emotional development needs  
44 [53], communication skills [46], frequency of pain care, gender, and interaction between educational  
45 level and religious faith [31], prior experiences and personal factors [37], sex and race [36]. These  
46 reports are heterogenous in their purpose and findings, therefore it is not possible to summarise the  
47 results. They do however provide concepts to be considered for pain education that are broader  
48 than the more frequently reported knowledge, skills, attitudes and beliefs about pain.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 The results of reports included in this review identify many problems with pain education, but also  
2 provide models, approaches and tools for suggested improvements. A summary of the problems and  
3 solutions identified are provided in table 2.  
4  
5  
6  
7  
8

### 9 **3.4. Concept analysis**

10 The results of this scoping review have provided a timeline, geography, inventory of included health  
11 professions, and synthesis of key findings in pain education research for pre-registration/pre-  
12 licensure health professionals  
13  
14  
15  
16

17 Further to this, a conceptual analysis was undertaken to identify and map key concepts relevant to  
18 the development or evaluation of pain education. The purpose of this was to develop a model that  
19 can be used as a reference tool to evaluate existing pain education, or to plan and develop future  
20 pain education for health professionals. Concepts, notions, and ideas were identified by reading all  
21 reports included in the scoping review several times to make sense of and gain understanding of the  
22 full dataset. Characteristics relevant to the design and evaluation of pain education along with key  
23 stakeholders in pain education were extracted and coded. Four overall key components of the  
24 educational process emerged relevant to the development or evaluation of pain education;  
25  
26  
27  
28  
29  
30  
31

#### 32 1. Student characteristics.

33 Student knowledge, skill, attitudes and beliefs are measurable by a range of quantitative and  
34 qualitative methodologies. The 'success' of pain education is commonly determined by  
35 these outcomes. Personal characteristics and prior experiences that students have  
36 encountered are also identified, and are possibly relevant in the design and evaluation of  
37 pain education. Students have provided useful insight when asked to evaluate their learning  
38 experience.  
39  
40  
41  
42  
43  
44

#### 45 2. Educator characteristics.

46 Knowledge, skill, attitudes and beliefs of educators and leaders in pain education are  
47 reported as part of the educational process. Similar to students, individual characteristics  
48 and experiences of educators are possibly relevant and influential in the design and  
49 evaluation of pain education. Educators and pain leaders are used as experts regarding the  
50 design, content and delivery of pain education, and can provide insight when asked to  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 evaluate education. Educators can take on the role of pain champion in an educational  
2 setting.

3  
4 3. Content and Delivery – when, how, and what to teach about pain.

5 Dedicating increased hours of pain education in curricula structured with core guidelines  
6 such as IASP pain curricula, are recommended. Increasing the number of taught hours using  
7 pedagogic approaches has shown to improve pain education (e.g. dedicated pain education  
8 such as e-learning modules/ inter-professional education). Providing and locating pain  
9 education in curricula to facilitate graduates that are confident to practice and bridging the  
10 gap into competent clinical practice is advised.

11  
12  
13  
14  
15  
16 4. Outcomes: patient and education.

17 The outcome of education (e.g. what has been learned), and the effect in clinical practice  
18 (e.g. patient outcome) is increasingly reported as being critical in pain education. Pain  
19 competencies are published and endorsed by IASP. Recipients of healthcare are key  
20 stakeholders that have provided significant contribution when they have been included in  
21 research.

22  
23  
24  
25  
26  
27 A conceptual model has been developed to aid stakeholders in the evaluation or development of  
28 pain education, and is provided in figure 3.

29  
30  
31  
32  
33  
34  
35 **4. DISCUSSION**

36  
37 This scoping review demonstrates the considerable amount of research that has been conducted to  
38 evaluate pain education for health professionals. There has been a significant increase in the number  
39 of published reports over recent years that have not only identified the problems leading to poor  
40 pain education but have also provided practical solutions.

41  
42  
43  
44  
45 Unfortunately, in practice the implementation of these solutions appears to be poor. Explanations  
46 for this are discussed in the literature. They include the need for greater implementation of core  
47 competencies for pain education, and for organisations that accredit/regulate health professions to  
48 take more responsibility for mandating and ensuring standards of pain education with health  
49 education programmes [27]. This review synthesis supports these findings and furthers the  
50 discussion by providing the context of problems and solutions to pain education based on twenty-  
51 five years of research.

1 This review located a large body of evidence indicating that student knowledge, skill, attitudes or  
2 beliefs about pain are mostly inadequate across the health professions. The problems with pain  
3 education were clearly articulated and consistent in their findings that pain often lacks attention in  
4 health curricula, and that pedagogic approaches do not necessarily facilitate the knowledge and  
5 skills that health professionals require to manage patients in pain. Delivering pain education within a  
6 biopsychosocial model was repeatedly reported as a critical approach to the assessment and  
7 management of pain, however education models often focus on educating health professionals in  
8 the biology and physiology of pain with the psychosocial aspects of pain gaining less attention. This  
9 is inadequate when patients living with chronic pain as a long term condition report that the  
10 psychosocial aspects of pain are what they struggle with the most [72]. The importance of managing  
11 the human side of illness and patient care has been reported in the literature for decades, and while  
12 this probably does feature in health professionals education, in many cases it still does not appear to  
13 be explicitly part of pain education [24].

24 There are resources available to improve the design of pain education. The IASP Education Initiatives  
25 Working Group developed interprofessional and uniprofessional pain curriculum outlines to be  
26 implemented in pre-registration/pre-licensure health courses. The curricula, which were updated in  
27 2017, are based on the four components of the IASP Core Curricula: i) multidimensional nature of  
28 pain, ii) pain assessment and measurement, iii) management of pain, and iv) clinical conditions, and  
29 are intended to instil the knowledge and skills necessary to advance the science and management of  
30 pain [2]. The increased uptake of these curricula in health courses is a foundation to building a  
31 biopsychosocial approach to pain education that meets the needs of patients living with pain.

39 Reports identified in this review demonstrated a variety of pedagogic approaches that can be used  
40 to improve outcomes for students, and are therefore suggested as options for the design of pain  
41 education in health professional courses. These include inter-professional workshops, e-learning  
42 modules, and short courses on pain that demonstrated improved outcomes for students [12; 42; 44;  
43 53; 56; 61; 66; 67; 75; 78; 81; 82]. This is supported by a qualitative analysis of faculty educators  
44 comments regarding pain education where successes were attributed to expansion of pain content  
45 in the curricula, explicitly integrating pain into curricula, and diversity of teaching methods where an  
46 innovative array of teaching approaches were used e.g. including service users in education,  
47 incorporating e-learning, and problem based learning [19]. In particular, interprofessional education  
48 has been advocated, often featuring as a major recommendation in reports on pain education  
49 across the health professions [4] [17].

1 Further to this, this review highlighted that other factors such as cultural beliefs, prior experiences,  
2 emotional intelligence, and the impact of sex and race, that may be influential in pain education.  
3 Again, some of these factors may feature in health professionals education, but there is little  
4 evidence that they form part of education specifically about pain. Considering these potentially  
5 influential factors may be important in the design and development of pain education as part of the  
6 concept of patient centred care [43]. A blueprint for integrating cognitive and affective dimensions  
7 of pain experience into health professionals education is provided in the literature that incorporates  
8 the emotional development of clinical trainees [52]. A description of the framework is provided  
9 which has been applied to the development and implementation of two new courses in pain.  
10

11  
12  
13  
14  
15  
16  
17 The role of faculty educators in pain education was identified by several reports in this review. In  
18 addition to knowledge and skill, the concept of attitudes and beliefs about pain and the influence  
19 this can have on the success and outcome of pain education is discussed. Having a team of people  
20 involved in teaching and a local champion, team or network of people influencing curriculum change  
21 has been proposed as way of improving successful delivery of pain education for health  
22 professionals [19].  
23  
24  
25  
26  
27

28  
29 The outcome of pain education has gained more attention in recent literature by the development  
30 of pain competencies and outcomes for healthcare students. In these reports the focus has shifted  
31 from what students have been taught, to what they have learned in order for them to become  
32 competent and confident health practitioners in pain practice [28; 33; 35]. Following the consensus  
33 on the development of core competencies a group of interprofessional faculty provided a follow-up  
34 of how to implement learning tools within teaching and curricula in pre-licensure health care.  
35 Suggestions and exemplars in applying core competencies for pain management are provided which  
36 include providing multiple opportunities for learners to overlap concepts for better depth of  
37 understanding, and to include learning concepts through visual metacognition where visual concepts  
38 create improved mental thinking or 'meta-cognition' [14]. The focus is to improve the application of  
39 knowledge and skills in 'practice settings' i.e. real-client situations. Profession specific  
40 recommendations to incorporate, apply and assess core competencies are provided for nurse [33],  
41 and physical therapy curricula in the USA [35].  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51

52 In the UK, the Royal College of Nurses (RCN), and the Physiotherapy Pain Association (PPA) have  
53 developed profession specific pain knowledge and skills frameworks for different staff grades  
54 working with people in pain. The RCN pain knowledge and skills framework is designed to guide and  
55  
56  
57



1 support the demonstration of competence by nurses when caring for people with pain [39]. The  
2 content of this document is split to meet the different needs of unregistered and registered nurses,  
3 therefore each group has its framework summary based on Benner's 1982 novice to expert levels of  
4 practice. The PPA framework entry level graduate to expert physiotherapists describes the values,  
5 behaviours, knowledge and skills of physiotherapists working with people in pain [7]. This document  
6 describes domains at four levels on a continuum from graduate entry level (newly qualified  
7 physiotherapist) to expert. It is described as a resource that will be used to develop descriptors of  
8 competence. The British Pain Society have recently published 'A Practical Guide to Incorporating  
9 Pain Education into Pre-registration Curricula for Healthcare Professionals in the UK' [5], which  
10 includes a comprehensive section on core curriculum outcomes for pain education.  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20

21 It is well documented that there is a gap between knowledge and practice in pain [38]. Wider uptake  
22 of pain competencies from the pre-registration/pre-licensure stage of training through to registered  
23 clinical staff aims to bridge the gap between knowledge and practice with greater focus on  
24 producing healthcare staff that are competent in pain practice. This model of education also  
25 facilitates a more natural step into continuing education that graduates have to undertake as part of  
26 a clinical career.  
27  
28  
29  
30  
31

32 This review identified a variety of methodologies used to examine or evaluate pain education. The  
33 most significant advancement of methodologies are the reports that have shifted the focus towards  
34 educational outcomes, however there is still a lack of research that has been conducted to evaluate  
35 how effective pain education is in influencing patient outcomes. There is also a significant lack of  
36 patient involvement in pain education research: incorporating patients in the design and evaluation  
37 of pain education, and pain education research is necessary to further develop curricula and to  
38 advance research methodologies so that meaningful outcomes for patients are evaluated.  
39  
40  
41  
42  
43  
44

45 To achieve better pain care a conceptual shift needs to occur where graduates are expected to have  
46 excellent pain knowledge and skills, that they can communicate with and listen to the needs of  
47 patients experiencing pain, and that they are confident in their pain practice.  
48  
49  
50

#### 51 **Future recommendations**

52 To develop methodologies in pain education research that map the causal pathways from pain  
53 education to patient outcomes.  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 To incorporate patients in developing the design, delivery and outcome of pain education curricula  
2 and research.  
3

4  
5 To advance pain education by shifting the delivery from a theory dense, to a clinical environment  
6 where contextual decision making in practice is encouraged.  
7

#### 8 **Limitations of the review**

9  
10 It is not within the scope of this review to report on the methodological quality of included reports,  
11 rather to provide a timeline, synthesis of, and map concepts within pain education research.  
12  
13

14  
15 This review identified many reports across the health professions. Others may exist that were not  
16 identified by the search strategy employed in this review. The health professions identified in the  
17 reports are bias to medicine, nursing and the allied health professions as these were the professions  
18 that formed part of the initial search strategy. Other professions such as veterinary science and  
19 dentistry were identified when they featured in larger studies that investigated pain education  
20 across the health sciences.  
21  
22  
23  
24  
25

#### 26 **Acknowledgments**

27  
28 This work was supported by a Health Education England (HEE) PhD Studentship.  
29

#### 30 **Conflict of interest statement**

31  
32 The authors have no conflict of interest to declare.  
33  
34

#### 35 **References**

- 36  
37  
38  
39  
40  
41 [1] Declaration of Montréal. Declaration that Access to Pain Management Is a Fundamental Human  
42 Right. <https://www.iasp-pain.org/DeclarationofMontreal>:<accessed January 2018>.  
43  
44 [2] <https://www.iasp-pain.org/Education/CurriculaList.aspx?navItemNumber=647>.  
45  
46 [3] Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and  
47 Research. Washington (DC), 2011.  
48  
49 [4] Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and  
50 Research. Mil Med 2016;181(5):397-399.  
51  
52 [5] Pre-registration Pain Education: A Practical Guide to Incorporating Pain Education into Pre-  
53 registration Curricula for Healthcare Professionals in the UK. British Pain Society  
54 [https://www.britishpainsociety.org/british-pain-society-publications/professional-](https://www.britishpainsociety.org/british-pain-society-publications/professional-publications/)  
55 [publications/](https://www.britishpainsociety.org/british-pain-society-publications/professional-publications/) 2018.  
56  
57 [6] Desirable Characteristics of National Pain Strategies: Recommendations by the International  
58 Association for the Study of Pain [https://s3amazonawscom/rdcms-](https://s3.amazonaws.com/rdcms-)

1 [iasp/files/production/public/Content/NavigationMenu/Advocacy/DesirableCharacteristics](http://iasp/files/production/public/Content/NavigationMenu/Advocacy/DesirableCharacteristics_Nov2011.pdf)  
2 [Nov2011.pdf](http://iasp/files/production/public/Content/NavigationMenu/Advocacy/DesirableCharacteristics_Nov2011.pdf) <accessed January 2018>.

- 3 [7] [http://ppa.csp.org.uk/documents/ppa-physiotherapy-framework-entry-level-graduate-expert-](http://ppa.csp.org.uk/documents/ppa-physiotherapy-framework-entry-level-graduate-expert-describing-values-behaviours)  
4 [describing-values-behaviours](http://ppa.csp.org.uk/documents/ppa-physiotherapy-framework-entry-level-graduate-expert-describing-values-behaviours).
- 5 [8] Adillón C, Lozano È, Salvat I. Comparison of pain neurophysiology knowledge among health  
6 sciences students: a cross-sectional study. *BMC Research Notes* 2015;8:592-592.
- 7 [9] Al-Khawaldeh OA, Al-Hussami M, Darawad M. Knowledge and attitudes regarding pain  
8 management among Jordanian nursing students. *Nurse education today* 2013;33(4):339-  
9 345.
- 10 [10] Al Khalaileh M, Al Qadire M. Pain management in Jordan: nursing students' knowledge and  
11 attitude. *British journal of nursing* (Mark Allen Publishing) 2013;22(21):1234-1240.
- 12 [11] Ali N, Thomson D. A comparison of the knowledge of chronic pain and its management between  
13 final year physiotherapy and medical students. *European journal of pain* 2009;13(1):38-50.
- 14 [12] Argyra E, Sifaka I, Moutzouri A, Papadopoulos V, Rekatsina M, Vadalouca A, Theodoraki K. How  
15 Does an Undergraduate Pain Course Influence Future Physicians' Awareness of Chronic Pain  
16 Concepts? A Comparative Study. *Pain Medicine* 2015;16(2):301-311.
- 17 [13] Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International*  
18 *Journal of Social Research Methodology* 2005;8(1):19-32.
- 19 [14] Arwood E, Rowe JM, Singh NS, Carr DB, Herr KA, Chou R. Implementing a paradigm shift:  
20 incorporating pain management competencies into pre-licensure curricula. *Pain Medicine*  
21 (Malden, Mass) 2015;16(2):291-300.
- 22 [15] Breivik H, Eisenberg E, O'Brien T. The individual and societal burden of chronic pain in Europe:  
23 the case for strategic prioritisation and action to improve knowledge and availability of  
24 appropriate care. *BMC Public Health* 2013;13:1229-1229.
- 25 [16] Briggs EV, Battelli D, Gordon D, Kopf A, Ribeiro S, Puig MM, Kress HG. Current pain education  
26 within undergraduate medical studies across Europe: Advancing the Provision of Pain  
27 Education and Learning (APPEAL) study. *BMJ open* 2015;5(8):e006984-e006984.
- 28 [17] Briggs EV, Carr EC, Whittaker MS. Survey of undergraduate pain curricula for healthcare  
29 professionals in the United Kingdom. *European journal of pain* 2011;15(8):789-795.
- 30 [18] Campbell WI. What do medical students know about chronic pain and its management? *The*  
31 *Ulster Medical Journal* 1992;61(2):139-143.
- 32 [19] Carr EC, Briggs EV, Briggs M, Allcock N, Black P, Jones D. Understanding factors that facilitate the  
33 inclusion of pain education in undergraduate curricula: Perspectives from a UK survey.  
34 *British journal of pain* 2016;10(2):100-107.
- 35 [20] Chan JCY, Hamamura T. Emotional Intelligence, Pain Knowledge, and Attitudes of Nursing  
36 Students in Hong Kong. *Pain Management Nursing: Official Journal Of The American Society*  
37 *Of Pain Management Nurses* 2016;17(2):159-168.
- 38 [21] Chiu LH, Trinca J, Lim LM, Tuazon JA. A study to evaluate the pain knowledge of two sub-  
39 populations of final year nursing students: Australia and Philippines. *Journal of advanced*  
40 *nursing* 2003;41(1):99-108.
- 41 [22] Doorenbos AZ, Gordon DB, Tauben D, Palisoc J, Drangsholt M, Lindhorst T, Danielson J, Spector  
42 J, Ballweg R, Vorvick L, Loeser JD. A blueprint of pain curriculum across prelicensure health  
43 sciences programs: one NIH Pain Consortium Center of Excellence in Pain Education (CoEPE)  
44 experience. *The journal of pain : official journal of the American Pain Society*  
45 2013;14(12):1533-1538.
- 46 [23] Duke G, Haas BK, Yarbrough S, Northam S. Pain management knowledge and attitudes of  
47 baccalaureate nursing students and faculty. *Pain management nursing : official journal of the*  
48 *American Society of Pain Management Nurses* 2013;14(1):11-19.

- 1 [24] Engel GL. THE BIOPSYCHOSOCIAL MODEL AND THE EDUCATION OF HEALTH PROFESSIONALS\*†.  
2 Annals of the New York Academy of Sciences 1978;310(1):169-181.
- 3 [25] Ferreira PH, Ferreira ML, Latimer J, Maher CG, Refshauge K, Sakamoto A, Garofalo R. Attitudes  
4 and beliefs of Brazilian and Australian physiotherapy students towards chronic back pain: a  
5 cross-cultural comparison. *Physiotherapy research international : the journal for researchers*  
6 *and clinicians in physical therapy* 2004;9(1):13-23.
- 7 [26] Ferrell BR, McGuire DB, Donovan MI. Knowledge and beliefs regarding pain in a sample of  
8 nursing faculty. *Journal of professional nursing : official journal of the American Association*  
9 *of Colleges of Nursing* 1993;9(2):79-88.
- 10 [27] Fishman SM, Young HM. Driving Needed Change in Pain Education. *Pain Medicine*  
11 2016;17(10):1790-1792.
- 12 [28] Fishman SM, Young HM, Lucas Arwood E, Chou R, Herr K, Murinson BB, Watt-Watson J, Carr DB,  
13 Gordon DB, Stevens BJ, Bakerjian D, Ballantyne JC, Courtenay M, Djukic M, Koebner IJ,  
14 Mongoven JM, Paice JA, Prasad R, Singh N, Sluka KA, St Marie B, Strassels SA. Core  
15 Competencies for Pain Management: Results of an Interprofessional Consensus Summit.  
16 *Pain Medicine (Malden, Mass)* 2013;14(7):971-981.
- 17 [29] Goldberg DS, McGee SJ. Pain as a global public health priority. *BMC Public Health*  
18 2011;11(1):770.
- 19 [30] Goodrich C. Students' and faculty members' knowledge and attitudes regarding pain  
20 management: a descriptive survey. *The Journal of nursing education* 2006;45(3):140-142.
- 21 [31] Greenberger C, Reches H, Riba S. Levels and predictors of knowledge and attitudes regarding  
22 pain among Israeli baccalaureate nursing students and nurses pursuing specialty  
23 certification. *International journal of nursing education scholarship* 2006;3:Article 8.
- 24 [32] Hadjistavropoulos HD, Juckes K, Dirkse D, Cuddington C, Walker K, Bruno P, White G, Ruda L,  
25 Pitzel Bazylewski M. Student evaluations of an interprofessional education experience in  
26 pain management. *J Interprof Care* 2015;29(1):73-75.
- 27 [33] Herr K, Marie BS, Gordon DB, Paice JA, Watt-Watson J, Stevens BJ, Bakerjian D, Young HM. An  
28 interprofessional consensus of core competencies for prelicensure education in pain  
29 management: curriculum application for nursing. *The Journal of nursing education*  
30 2015;54(6):317-327.
- 31 [34] Hoeger Bement MK, Sluka KA. The current state of physical therapy pain curricula in the United  
32 States: a faculty survey. *Journal of Pain* 2015;16(2):144-152.
- 33 [35] Hoeger Bement MK, St. Marie BJ, Nordstrom TM, Christensen N, Mongoven JM, Koebner IJ,  
34 Fishman SM, Sluka KA. An Interprofessional Consensus of Core Competencies for  
35 Prelicensure Education in Pain Management: Curriculum Application for Physical Therapy.  
36 *Physical Therapy* 2014;94(4):451-465.
- 37 [36] Hollingshead NA, Matthias MS, Bair MJ, Hirsh AT. Impact of Race and Sex on Pain Management  
38 by Medical Trainees: A Mixed Methods Pilot Study of Decision Making and Awareness of  
39 Influence. *Pain Medicine* 2015;16(2):280-290.
- 40 [37] Hollingshead NA, Meints S, Middleton SK, Free CA, Hirsh AT. Examining influential factors in  
41 providers' chronic pain treatment decisions: a comparison of physicians and medical  
42 students. *BMC Medical Education* 2015;15:164-164.
- 43 [38] <https://www.iasp-pain.org/GlobalYear>.
- 44 [39] <https://www.rcn.org.uk/professional-development/publications/pub-004984>.
- 45 [40] Jackson T, Thomas S, Stabile V, Han X, Shotwell M, McQueen K. Prevalence of chronic pain in  
46 low-income and middle-income countries: a systematic review and meta-analysis. *The*  
47 *Lancet*;385:S10.

- 1 [41] Jones MP. Teaching nursing students about chronic pain: The lived experience perspective of  
2 nurse educators. *Journal of Nursing Education & Practice* 2015;5(4):19-31.
- 3 [42] Keefe G, Wharrad HJ. Using e-learning to enhance nursing students' pain management  
4 education. *Nurse education today* 2012;32(8):e66-72.
- 5 [43] Kitson A, Marshall A, Bassett K, Zeitz K. What are the core elements of patient-centred care? A  
6 narrative review and synthesis of the literature from health policy, medicine and nursing.  
7 *Journal of advanced nursing* 2013;69(1):4-15.
- 8 [44] Latimer J, Maher C, Refshauge K. The attitudes and beliefs of physiotherapy students to chronic  
9 back pain. *The Clinical journal of pain* 2004;20(1):45-50.
- 10 [45] Leegaard M, Valeberg BT, Haugstad GK, Utne I. Survey of Pain Curricula for Healthcare  
11 Professionals in Norway. *Nordic Journal of Nursing Research* 2014;34(1):42-45.
- 12 [46] Leila NM, Pirkko H, Eeva P, Eija K, Reino P. Training medical students to manage a chronic pain  
13 patient: both knowledge and communication skills are needed. *European journal of pain*  
14 2006;10(2):167-170.
- 15 [47] Mackintosh-Franklin C. The impact of experience on undergraduate preregistration student  
16 nurses' responses to patients in pain: a 2-year qualitative longitudinal study. *Pain  
17 management nursing : official journal of the American Society of Pain Management Nurses*  
18 2014;15(1):199-207.
- 19 [48] Mackintosh-Franklin C. Pain: A content review of undergraduate pre-registration nurse  
20 education in the United Kingdom. *Nurse education today* 2017;48:84-89.
- 21 [49] Mezei L, Murinson BB, Johns Hopkins Pain Curriculum Development T. Pain education in North  
22 American medical schools. *The journal of pain : official journal of the American Pain Society*  
23 2011;12(12):1199-1208.
- 24 [50] Morris H, Ryan, D. Lauchlan., Field, M. "Do medical student attitudes towards patients with  
25 chronic low back pain improve during training? a cross-sectional study." *BMC Medical  
26 Education* 2012;12:10.
- 27 [51] Murinson BB, Gordin V, Flynn S, Driver LC, Gallagher RM, Grabois M, Medical Student Education  
28 Sub-committee of the American Academy of Pain M. Recommendations for a new  
29 curriculum in pain medicine for medical students: toward a career distinguished by  
30 competence and compassion. *Pain Med* 2013;14(3):345-350.
- 31 [52] Murinson BB, Mezei L, Nenortas E. Integrating cognitive and affective dimensions of pain  
32 experience into health professions education. *Pain Research & Management : The Journal of  
33 the Canadian Pain Society* 2011;16(6):421-426.
- 34 [53] Murinson BB, Nenortas E, Mayer RS, Mezei L, Kozachik S, Nesbit S, Haythornthwaite JA,  
35 Campbell JN. A new program in pain medicine for medical students: integrating core  
36 curriculum knowledge with emotional and reflective development. *Pain Med*  
37 2011;12(2):186-195.
- 38 [54] Niemi-Murola L, Nieminen JT, Kalso E, Poyhia R. Medical undergraduate students' beliefs and  
39 attitudes toward pain: how do they mature? *European journal of pain* 2007;11(6):700-706.
- 40 [55] Plaisance L, Logan C. Nursing students' knowledge and attitudes regarding pain. *Pain  
41 management nursing : official journal of the American Society of Pain Management Nurses*  
42 2006;7(4):167-175.
- 43 [56] Puljak L, Sapunar D. Web-Based Elective Courses for Medical Students: An Example in Pain. *Pain  
44 Medicine* 2011;12(6):854-863.
- 45 [57] Rahimi-Madiseh M, Tavakol M, Dennick R. A quantitative study of Iranian nursing students'  
46 knowledge and attitudes towards pain: implication for education. *International journal of  
47 nursing practice* 2010;16(5):478-483.
- 48 [58] Rice ASC, Smith BH, Blyth FM. Pain and the global burden of disease. *Pain* 2016;157(4):791-796.

- 1 [59] Rochman D, Sheehan M, J Kulich R. Evaluation of a pain curriculum for occupational therapists:  
2 Experiences from a master's-level graduate program over six years, Vol. 35, 2013.
- 3 [60] Rochman DL. Students' knowledge of pain: a survey of four schools. *Occupational Therapy*  
4 *International* 1998;5(2):140-154.
- 5 [61] Rochman DL, Sheehan MJ, Kulich RJ. Evaluation of a pain curriculum for occupational therapists:  
6 experiences from a master's-level graduate program over six years. *Disability and*  
7 *rehabilitation* 2013;35(22):1933-1940.
- 8 [62] Ryan C, Murphy D, Clark M, Lee A. The effect of a physiotherapy education compared with a  
9 non-healthcare education on the attitudes and beliefs of students towards functioning in  
10 individuals with back pain: an observational, cross-sectional study. *Physiotherapy*  
11 2010;96(2):144-150.
- 12 [63] Ryan R. Cochrane Consumers and Communication Review Group. 'Cochrane Consumers and  
13 Communication Review Group: data synthesis and analysis' JUNE 2013 <accessed 13th  
14 December 2016>.
- 15 [64] Scudds RJ, Scudds RA, Simmonds MJ. Pain in the physical therapy (pt) curriculum: a faculty  
16 survey. *Physiotherapy Theory and Practice* 2001;17(4):239-256.
- 17 [65] Shaw S, Lee A. Student Nurses' Misconceptions of Adults with Chronic Nonmalignant Pain. *Pain*  
18 *Management Nursing*;11(1):2-14.
- 19 [66] Stevens DL, King D, Laponis R, Hanley K, Zabar S, Kalet AL, Gillespie C. Medical students retain  
20 pain assessment and management skills long after an experiential curriculum: a controlled  
21 study. *Pain* 2009;145(3):319-324.
- 22 [67] Strong J, Meredith P, Darnell R, Chong M, Roche P. Does participation in a pain course based on  
23 the International Association for the Study of Pain's curricula guidelines change student  
24 knowledge about pain? *Pain research & management* 2003;8(3):137-142.
- 25 [68] Strong J, Tooth L, Unruh A. Knowledge about pain among newly graduated occupational  
26 therapists: relevance for curriculum development. *Canadian journal of occupational therapy*  
27 *Revue canadienne d'ergotherapie* 1999;66(5):221-228.
- 28 [69] Tellier PP, Belanger E, Rodriguez C, Ware MA, Posel N. Improving undergraduate medical  
29 education about pain assessment and management: a qualitative descriptive study of  
30 stakeholders' perceptions. *Pain research & management* 2013;18(5):259-265.
- 31 [70] Thompson K, Milligan J, Johnson M, Briggs M. Pain education in professional health courses - a  
32 scoping review of standards, protocols and frameworks. *Physiotherapy* 2016;102:e37-e38.
- 33 [71] Thompson K, Milligan J, Johnson MI, Briggs M. Pain education in pre-registration professional  
34 health courses: a protocol for a scoping review. *BMJ open* 2016;6(7):e012001.
- 35 [72] Toye F, Seers K, Allcock N, Briggs M, Carr E, Andrews J, Barker K. A meta-ethnography of  
36 patients' experience of chronic non-malignant musculoskeletal pain. Southampton (UK),  
37 2013.
- 38 [73] Turner GH, Weiner DK. Essential components of a medical student curriculum on chronic pain  
39 management in older adults: results of a modified delphi process. *Pain Med* 2002;3(3):240-  
40 252.
- 41 [74] Twycross A. Education about pain: a neglected area? *Nurse education today* 2000;20(3):244-  
42 253.
- 43 [75] Unruh A. Teaching student occupational therapists about pain: a course evaluation." *Canadian*  
44 *Journal of Occupational Therapy*. *Canadian Journal of Occupational Therapy* 1995:30-36.
- 45 [76] Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, Charlson F, Davis A, Degenhardt  
46 L, Dicker D, Duan L, Erskine H, Feigin VL, Ferrari AJ, Fitzmaurice C, Fleming T, Graetz N,  
47 Guinovart C, Haagsma J, Hansen GM, Hanson SW, Heuton KR, Higashi H, Kassebaum N, Kyu  
48 H, Laurie E, Liang X, Lofgren K, Lozano R, MacIntyre MF, Moradi-Lakeh M, Naghavi M,

1 Nguyen G, Odell S, Ortblad K, Roberts DA, Roth GA, Sandar L, Serina PT, Stanaway JD, Steiner  
2 C, Thomas B, Vollset SE, Whiteford H, Wolock TM, Ye P, Zhou M, Ávila MA, Aasvang GM,  
3 Abbafati C, Ozgoren AA, Abd-Allah F, Aziz MIA, Abera SF, Aboyans V, Abraham JP, Abraham  
4 B, Abubakar I, Abu-Raddad LJ, Abu-Rmeileh NME, Aburto TC, Achoki T, Ackerman IN,  
5 Adelekan A, Ademi Z, Adou AK, Adsuar JC, Arnlov J, Agardh EE, Al Khabouri MJ, Alam SS,  
6 Alasfoor D, Albittar MI, Alegretti MA, Aleman AV, Alemu ZA, Alfonso-Cristancho R, Alhabib S,  
7 Ali R, Alla F, Allebeck P, Allen PJ, AlMazroa MA, Alsharif U, Alvarez E, Alvis-Guzman N, Ameli  
8 O, Amini H, Ammar W, Anderson BO, Anderson HR, Antonio CAT, Anwari P, Apfel H,  
9 Arsenijevic VSA, Artaman A, Asghar RJ, Assadi R, Atkins LS, Atkinson C, Badawi A, Bahit MC,  
10 Bakfalouni T, Balakrishnan K, Balalla S, Banerjee A, Barker-Collo SL, Barquera S, Barregard L,  
11 Barrero LH, Basu S, Basu A, Baxter A, Beardsley J, Bedi N, Beghi E, Bekele T, Bell ML, Benjet C,  
12 Bennett DA, Bensenor IM, Benzian H, Bernabe E, Beyene TJ, Bhalra N, Bhalla A, Bhutta Z,  
13 Bienhoff K, Bikbov B, Abdulhak AB, Blore JD, Blyth FM, Bohensky MA, Basara BB, Borges G,  
14 Bornstein NM, Bose D, Boufous S, Bourne RR, Boyers LN, Brainin M, Brauer M, Brayne CEG,  
15 Brazinova A, Breitborde NJK, Brenner H, Briggs ADM, Brooks PM, Brown J, Brugha TS,  
16 Buchbinder R, Buckle GC, Bukhman G, Bulloch AG, Burch M, Burnett R, Cardenas R, Cabral  
17 NL, Nonato IRC, Campuzano JC, Carapetis JR, Carpenter DO, Caso V, Castaneda-Orjuela CA,  
18 Catala-Lopez F, Chadha VK, Chang J-C, Chen H, Chen W, Chiang PP, Chimed-Ochir O,  
19 Chowdhury R, Christensen H, Christophi CA, Chugh SS, Cirillo M, Coggeshall M, Cohen A,  
20 Colistro V, Colquhoun SM, Contreras AG, Cooper LT, Cooper C, Cooperrider K, Coresh J,  
21 Cortinovis M, Criqui MH, Crump JA, Cuevas-Nasu L, Dandona R, Dandona L, Dansereau E,  
22 Dantes HG, Dargan PI, Davey G, Davitoiu DV, Dayama A, De la Cruz-Gongora V, de la Vega SF,  
23 De Leo D, del Pozo-Cruz B, Dellavalle RP, Deribe K, Derrett S, Des Jarlais DC, Dessalegn M,  
24 deVeber GA, Dharmaratne SD, Diaz-Torne C, Ding EL, Dokova K, Dorsey ER, Driscoll TR,  
25 Duber H, Durrani AM, Edmond KM, Ellenbogen RG, Endres M, Ermakov SP, Eshrati B,  
26 Esteghamati A, Estep K, Fahimi S, Farzadfar F, Fay DFJ, Felson DT, Fereshtehnejad S-M,  
27 Fernandes JG, Ferri CP, Flaxman A, Foigt N, Foreman KJ, Fowkes FGR, Franklin RC, Furst T,  
28 Futran ND, Gabbe BJ, Gankpe FG, Garcia-Guerra FA, Geleijnse JM, Gessner BD, Gibney KB,  
29 Gillum RF, Ginawi IA, Giroud M, Giussani G, Goenka S, Goginashvili K, Gona P, de Cosio TG,  
30 Gosselin RA, Gotay CC, Goto A, Gouda HN, Guerrant RI, Gughani HC, Gunnell D, Gupta R,  
31 Gupta R, Gutierrez RA, Hafezi-Nejad N, Hagan H, Halasa Y, Hamadeh RR, Hamavid H,  
32 Hammami M, Hankey GJ, Hao Y, Harb HL, Haro JM, Havmoeller R, Hay RJ, Hay S, Hedayati  
33 MT, Pi IBH, Heydarpour P, Hajar M, Hoek HW, Hoffman HJ, Hornberger JC, Hosgood HD,  
34 Hossain M, Hotez PJ, Hoy DG, Hsairi M, Hu H, Hu G, Huang JJ, Huang C, Huiart L, Husseini A,  
35 Iannarone M, Iburg KM, Innos K, Inoue M, Jacobsen KH, Jassal SK, Jeemon P, Jensen PN, Jha  
36 V, Jiang G, Jiang Y, Jonas JB, Joseph J, Juel K, Kan H, Karch A, Karimkhani C, Karthikeyan G,  
37 Katz R, Kaul A, Kawakami N, Kazi DS, Kemp AH, Kengne AP, Khader YS, Khalifa SEAH, Khan EA,  
38 Khan G, Khang Y-H, Khonelidze I, Kieling C, Kim D, Kim S, Kimokoti RW, Kinfu Y, Kinge JM,  
39 Kissela BM, Kivipelto M, Knibbs L, Knudsen AK, Kokubo Y, Kosen S, Kramer A, Kravchenko M,  
40 Krishnamurthi RV, Krishnaswami S, Defo BK, Bicer BK, Kuipers EJ, Kulkarni VS, Kumar K,  
41 Kumar GA, Kwan GF, Lai T, Laloo R, Lam H, Lan Q, Lansingh VC, Larson H, Larsson A,  
42 Lawrynowicz AEB, Leasher JL, Lee J-T, Leigh J, Leung R, Levi M, Li B, Li Y, Li Y, liang J, Lim S, Lin  
43 H-H, Lind M, Lindsay MP, Lipshultz SE, Liu S, Lloyd BK, Ohno SL, Logroscino G, Looker KJ,  
44 Lopez AD, Lopez-Olmedo N, Lortet-Tieulent J, Lotufo PA, Low N, Lucas RM, Lunevicius R,  
45 Lyons RA, Ma J, Ma S, Mackay MT, Majdan M, Malekzadeh R, Mapoma CC, Marcenes W,  
46 March LM, Margono C, Marks GB, Marzan MB, Masci JR, Mason-Jones AJ, Matzopoulos RG,  
47 Mayosi BM, Mazorodze TT, McGill NW, McGrath JJ, McKee M, McLain A, McMahon BJ,  
48 Meaney PA, Mehndiratta MM, Mejia-Rodriguez F, Mekonnen W, Melaku YA, Meltzer M,  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

1 Memish ZA, Mensah G, Meretoja A, Mhimbira FA, Micha R, Miller TR, Mills EJ, Mitchell PB,  
2 Mock CN, Moffitt TE, Ibrahim NM, Mohammad KA, Mokdad AH, Mola GL, Monasta L,  
3 Montico M, Montine TJ, Moore AR, Moran AE, Morawska L, Mori R, Moschandreas J, Moturi  
4 WN, Moyer M, Mozaffarian D, Mueller UO, Mukaigawara M, Murdoch ME, Murray J, Murthy  
5 KS, Naghavi P, Nahas Z, Naheed A, Naidoo KS, Naldi L, Nand D, Nangia V, Narayan KMV, Nash  
6 D, Nejjari C, Neupane SP, Newman LM, Newton CR, Ng M, Ngalesoni FN, Nhung NT, Nisar MI,  
7 Nolte S, Norheim OF, Norman RE, Norrving B, Nyakarahuka L, Oh IH, Ohkubo T, Omer SB,  
8 Opio JN, Ortiz A, Pandian JD, Panelo CIA, Papachristou C, Park E-K, Parry CD, Caicedo AJP,  
9 Patten SB, Paul VK, Pavlin BI, Pearce N, Pedraza LS, Pellegrini CA, Pereira DM, Perez-Ruiz FP,  
10 Perico N, Pervaiz A, Pesudovs K, Peterson CB, Petzold M, Phillips MR, Phillips D, Phillips B,  
11 Piel FB, Plass D, Poenaru D, Polanczyk GV, Polinder S, Pope CA, Popova S, Poulton RG,  
12 Pourmalek F, Prabhakaran D, Prasad NM, Qato D, Quistberg DA, Rafay A, Rahimi K, Rahimi-  
13 Movaghar V, Rahman Su, Raju M, Rakovac I, Rana SM, Razavi H, Refaat A, Rehm J, Remuzzi  
14 G, Resnikoff S, Ribeiro AL, Riccio PM, Richardson L, Richardus JH, Riederer AM, Robinson M,  
15 Roca A, Rodriguez A, Rojas-Rueda D, Ronfani L, Rothenbacher D, Roy N, Ruhago GM, Sabin  
16 N, Sacco RL, Ksoreide K, Saha S, Sahathevan R, Sahraian MA, Sampson U, Sanabria JR,  
17 Sanchez-Riera L, Santos IS, Satpathy M, Saunders JE, Sawhney M, Saylan MI, Scarborough P,  
18 Schoettker B, Schneider IJC, Schwebel DC, Scott JG, Seedat S, Sepanlou SG, Serdar B, Servan-  
19 Mori EE, Shackelford K, Shaheen A, Shahraz S, Levy TS, Shangguan S, She J, Sheikhbahaei S,  
20 Shepard DS, Shi P, Shibuya K, Shinohara Y, Shiri R, Shishani K, Shiue I, Shrimel MG,  
21 Sigfusdottir ID, Silberberg DH, Simard EP, Sindi S, Singh JA, Singh L, Skirbekk V, Sliwa K, Soljak  
22 M, Soneji S, Soshnikov SS, Speyer P, Sposato LA, Sreeramareddy CT, Stoeckl H, Stathopoulou  
23 VK, Steckling N, Stein MB, Stein DJ, Steiner TJ, Stewart A, Stork E, Stovner LJ, Stroumpoulis K,  
24 Sturua L, Sunguya BF, Swaroop M, Sykes BL, Tabb KM, Takahashi K, Tan F, Tandon N, Tanne  
25 D, Tanner M, Tavakkoli M, Taylor HR, Te Ao BJ, Temesgen AM, Have MT, Tenkorang EY,  
26 Terkawi AS, Theadom AM, Thomas E, Thorne-Lyman AL, Thrift AG, Tleyjeh IM, Tonelli M,  
27 Topouzis F, Towbin JA, Toyoshima H, Traebert J, Tran BX, Trasande L, Trillini M, Truelsen T,  
28 Trujillo U, Tsilimbaris M, Tuzcu EM, Ukwaja KN, Undurraga EA, Uzun SB, van Brakel WH, van  
29 de Vijver S, Dingenen RV, van Gool CH, Varakin YY, Vasankari TJ, Vavilala MS, Veerman LJ,  
30 Velasquez-Melendez G, Venketasubramanian N, Vijayakumar L, Villalpando S, Violante FS,  
31 Vlassov VV, Waller S, Wallin MT, Wan X, Wang L, Wang J, Wang Y, Warouw TS, Weichenthal  
32 S, Weiderpass E, Weintraub RG, Werdecker A, Wessells KRR, Westerman R, Wilkinson JD,  
33 Williams HC, Williams TN, Woldeyohannes SM, Wolfe CDA, Wong JQ, Wong H, Woolf AD,  
34 Wright JL, Wurtz B, Xu G, Yang G, Yano Y, Yenesew MA, Yentur GK, Yip P, Yonemoto N, Yoon  
35 S-J, Younis M, Yu C, Kim KY, Zaki MES, Zhang Y, Zhao Z, Zhao Y, Zhu J, Zonies D, Zunt JR,  
36 Salomon JA, Murray CJL. Global, regional, and national incidence, prevalence, and years lived  
37 with disability for 301 acute and chronic diseases and injuries in 188 countries,  
38 1990&#x2013;2013: a systematic analysis for the Global Burden of Disease Study 2013. *The  
39 Lancet*;386(9995):743-800.

- 40  
41  
42  
43  
44  
45  
46  
47 [77] Voshall B, Dunn KS, Shelestak D. Knowledge and attitudes of pain management among nursing  
48 faculty. *Pain management nursing : official journal of the American Society of Pain  
49 Management Nurses* 2013;14(4):e226-235.
- 50 [78] Watt-Watson J, Hunter J, Pennefather P, Librach L, Raman-Wilms L, Schreiber M, Lax L, Stinson  
51 J, Dao T, Gordon A, Mock D, Salter M. An integrated undergraduate pain curriculum, based  
52 on IASP curricula, for six health science faculties. *Pain* 2004;110(1-2):140-148.
- 53 [79] Watt-Watson J, McGillion M, Hunter J, Choiniere M, Clark A, Dewar A, Johnston C, Lynch M,  
54 Morley-Forster P, Moulin D. A survey of prelicensure pain curricula in health science faculties  
55 in Canadian universities. *Pain Research and Management* 2009;14(6):439-444.
- 56  
57  
58  
59  
60  
61  
62  
63  
64  
65



- 1 [80] Watt-Watson J, Peter E, Clark AJ, Dewar A, Hadjistavropoulos T, Morley-Forster P, O'Leary C,  
2 Raman-Wilms L, Unruh A, Webber K, Campbell-Yeo M. The ethics of Canadian entry-to-  
3 practice pain competencies: how are we doing? *Pain research & management*  
4 2013;18(1):25-32.
- 5 [81] Weiner DK, Morone NE, Spallek H, Karp JF, Schneider M, Washburn C, Dziabiak MP, Hennon JG,  
6 Elnicki DM, University of Pittsburgh Center of Excellence in Pain E. E-learning module on  
7 chronic low back pain in older adults: evidence of effect on medical student objective  
8 structured clinical examination performance. *Journal of the American Geriatrics Society*  
9 2014;62(6):1161-1167.
- 10 [82] Wilson JF, Brockopp GW, Kryst S, Steger H, Witt WO. Medical students' attitudes toward pain  
11 before and after a brief course on pain. *Pain* 1992;50(3):251-256.
- 12 [83] Zalon ML. Pain management instruction in nursing curricula. *The Journal of nursing education*  
13 1995;34(6):262-267.
- 14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

**Figure legends**

Figure 1. Search strategy.

Figure 2. Timeline of reports that have examined or evaluated pain education.

Figure 3. Conceptual model.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

Figure 3

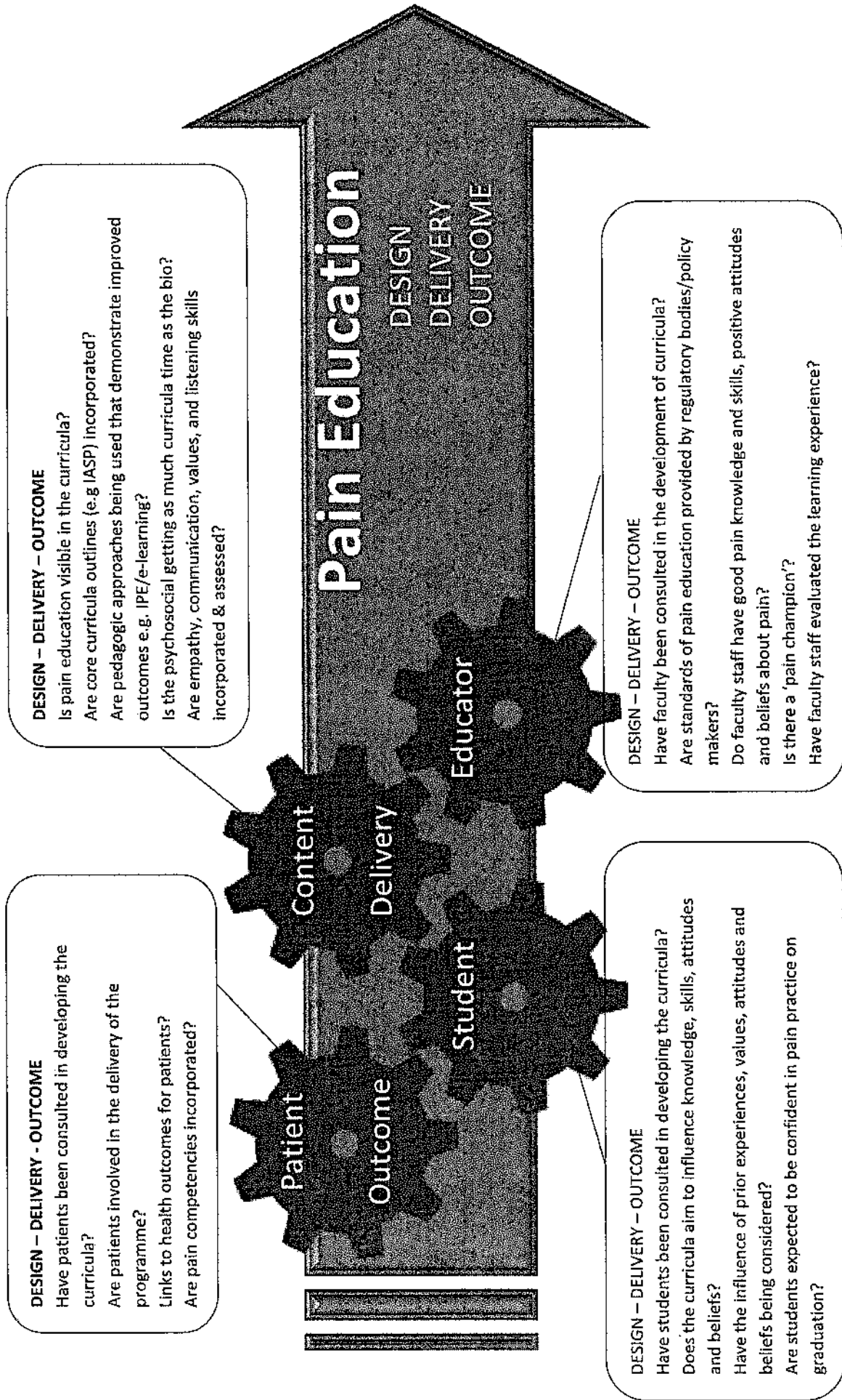


Figure 1

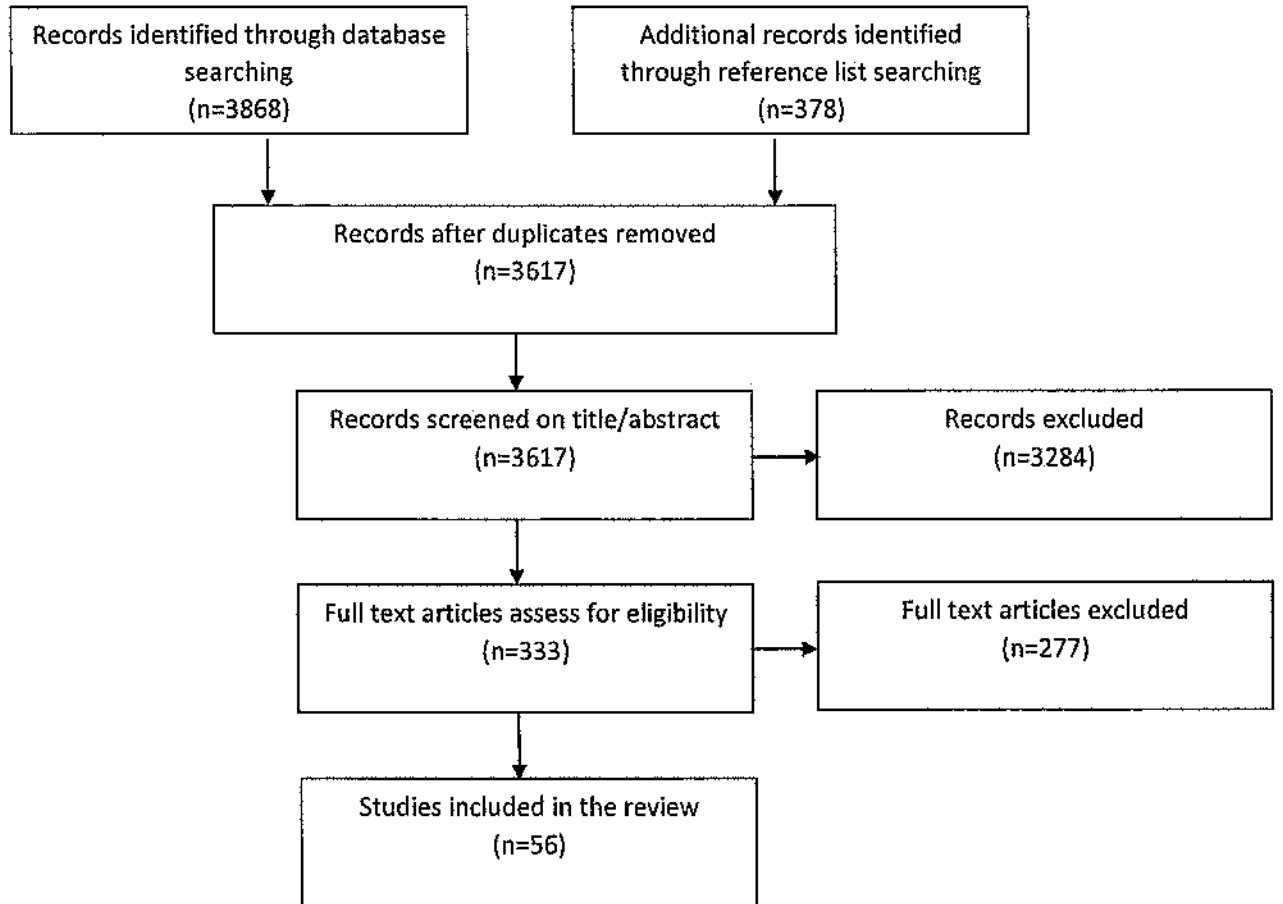


Figure 2

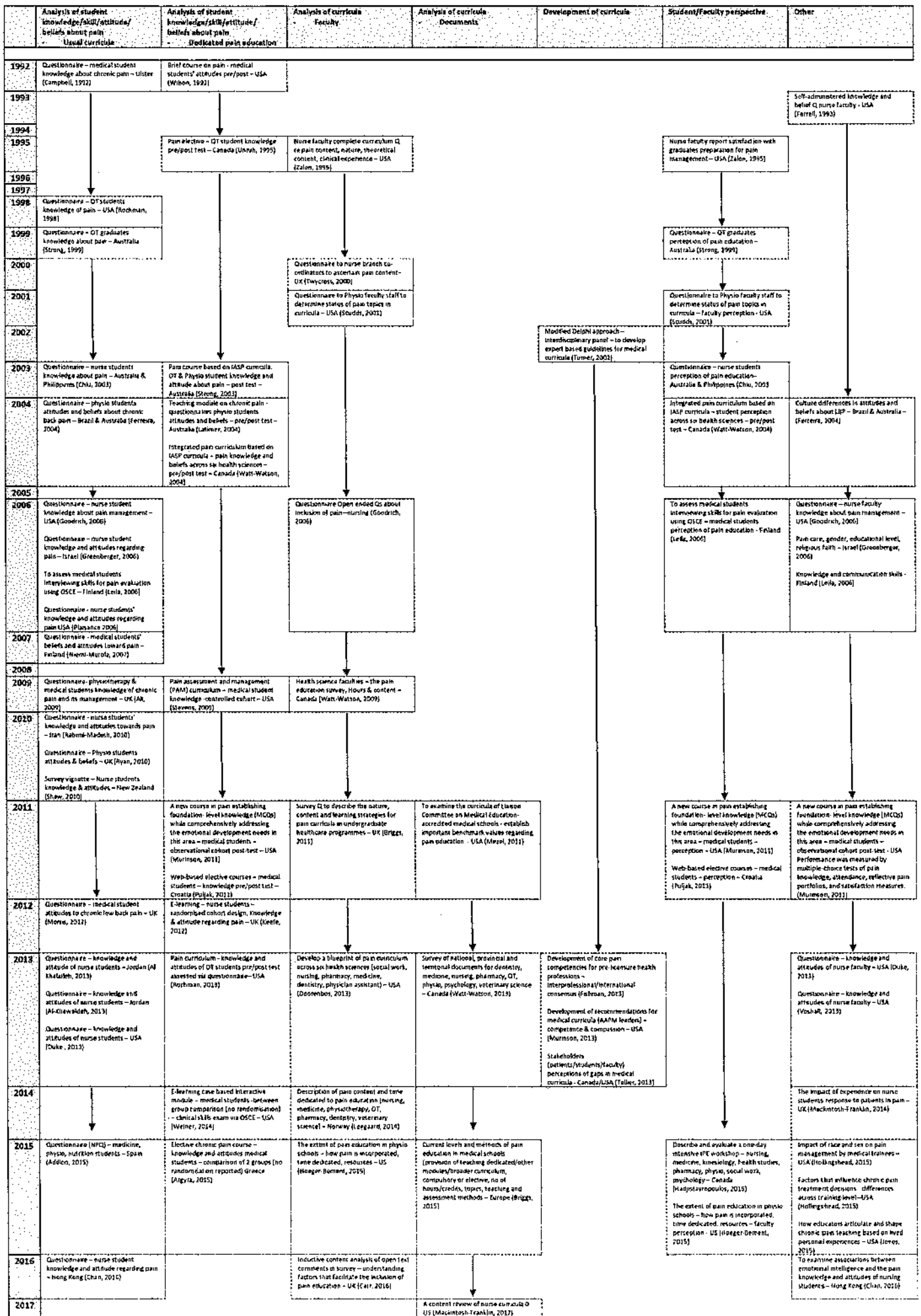


Table 1

Table 1. Table of included reports

Adillón C, Lozano É, Salvat I. Comparison of pain neurophysiology knowledge among health sciences students: a cross-sectional study. <i>BMC Research Notes</i> 2015;8:592-592.
Al Khalailah M, Al Qadire M. Pain management in Jordan: nursing students' knowledge and attitude. <i>British journal of nursing (Mark Allen Publishing)</i> 2013;22(21):1234-1240.
Ali N, Thomson D. A comparison of the knowledge of chronic pain and its management between final year physiotherapy and medical students. <i>European journal of pain</i> 2009;13(1):38-50.
Al-Khawaldeh OA, Al-Hussami M, Darawad M. Knowledge and attitudes regarding pain management among Jordanian nursing students. <i>Nurse education today</i> 2013;33(4):339-345.
Argyra E, Sifaka I, Moutzouri A, Papadopoulos V, Rekatsina M, Vadalouca A, Theodoraki K. How Does an Undergraduate Pain Course Influence Future Physicians' Awareness of Chronic Pain Concepts? A Comparative Study. <i>Pain Medicine</i> 2015;16(2):301-311.
Briggs EV, Battelli D, Gordon D, Kopf A, Ribeiro S, Puig MM, Kress HG. Current pain education within undergraduate medical studies across Europe: Advancing the Provision of Pain Education and Learning (APPEAL) study. <i>BMJ open</i> 2015;5(8):e006984-e006984.
Briggs EV, Carr EC, Whittaker MS. Survey of undergraduate pain curricula for healthcare professionals in the United Kingdom. <i>European journal of pain</i> 2011;15(8):789-795.
Campbell WJ. What do medical students know about chronic pain and its management? <i>The Ulster Medical Journal</i> 1992;61(2):139-143.
Carr EC, Briggs EV, Briggs M, Allcock N, Black P, Jones D. Understanding factors that facilitate the inclusion of pain education in undergraduate curricula: Perspectives from a UK survey. <i>British journal of pain</i> 2016;10(2):100-107.
Chan JCY, Hamamura T. Emotional Intelligence, Pain Knowledge, and Attitudes of Nursing Students in Hong Kong. <i>Pain Management Nursing: Official Journal Of The American Society Of Pain Management Nurses</i> 2016;17(2):159-168.
Chiu LH, Trinca J, Lim LM, Tuazon JA. A study to evaluate the pain knowledge of two sub-populations of final year nursing students: Australia and Philippines. <i>Journal of advanced nursing</i> 2003;41(1):99-108.
Doorenbos AZ, Gordon DB, Tauben D, Palisoc J, Drangsholt M, Lindhorst T, Danielson J, Spector J, Ballweg R, Vorvick L, Loeser JD. A blueprint of pain curriculum across prelicensure health sciences programs: one NIH Pain Consortium Center of Excellence in Pain Education (CoEPE) experience. <i>The journal of pain : official journal of the American Pain Society</i> 2013;14(12):1533-1538.
Duke G, Haas BK, Yarbrough S, Northam S. Pain management knowledge and attitudes of baccalaureate nursing students and faculty. <i>Pain management nursing : official journal of the American Society of Pain Management Nurses</i> 2013;14(1):11-19.
Ferreira PH, Ferreira ML, Latimer J, Maher CG, Refshauge K, Sakamoto A, Garofalo R. Attitudes and beliefs of Brazilian and Australian physiotherapy students towards chronic back pain: a cross-cultural comparison. <i>Physiotherapy research international : the journal for researchers and clinicians in physical therapy</i> 2004;9(1):13-23.
Ferrell BR, McGuire DB, Donovan MI. Knowledge and beliefs regarding pain in a sample of nursing faculty. <i>Journal of professional nursing : official journal of the American Association of Colleges of Nursing</i> 1993;9(2):79-88.
Fishman SM, Young HM, Lucas Arwood E, Chou R, Herr K, Murinson BB, Watt-Watson J, Carr DB, Gordon DB, Stevens BJ, Bakerjian D, Ballantyne JC, Courtenay M, Djukic M, Koebner JJ, Mongoven JM, Paice JA, Prasad R, Singh N, Sluka KA, St Marie B, Strassels SA. Core Competencies for Pain Management: Results of an Interprofessional Consensus Summit. <i>Pain Medicine (Malden, Mass)</i> 2013;14(7):971-981.
Goodrich C. Students' and faculty members' knowledge and attitudes regarding pain management: a descriptive survey. <i>The Journal of nursing education</i> 2006;45(3):140-142.
Greenberger C, Reches H, Riba S. Levels and predictors of knowledge and attitudes regarding pain among Israeli baccalaureate nursing students and nurses pursuing specialty certification. <i>International journal of nursing education scholarship</i> 2006;3:Article 8.
Hadjistavropoulos HD, Juckes K, Dirkse D, Cuddington C, Walker K, Bruno P, White G, Ruda L, Pitzel Bazylewski M. Student evaluations of an interprofessional education experience in pain management. <i>Journal Of Interprofessional Care</i> 2015;29(1):73-75.
Hoeger Bement MK, Sluka KA. The current state of physical therapy pain curricula in the United States: a faculty survey. <i>Journal of Pain</i> 2015;16(2):144-152.
Hollingshead NA, Matthias MS, Bair MJ, Hirsh AT. Impact of Race and Sex on Pain Management by Medical Trainees: A Mixed Methods Pilot Study of Decision Making and Awareness of Influence. <i>Pain Medicine</i> 2015;16(2):280-290.
Hollingshead NA, Meints S, Middleton SK, Free CA, Hirsh AT. Examining influential factors in providers' chronic pain treatment

decisions: a comparison of physicians and medical students. <i>BMC Medical Education</i> 2015;15:164-164.
Jones MP. Teaching nursing students about chronic pain: The lived experience perspective of nurse educators. <i>Journal of Nursing Education &amp; Practice</i> 2015;5(4):19-31.
Keefe G, Wharrad HJ. Using e-learning to enhance nursing students' pain management education. <i>Nurse education today</i> 2012;32(8):e66-72.
Latimer J, Maher C, Refshaug K. The attitudes and beliefs of physiotherapy students to chronic back pain. <i>The Clinical journal of pain</i> 2004;20(1):45-50.
Leegaard M, Valeberg BT, Haugstad GK, Utne I. Survey of Pain Curricula for Healthcare Professionals in Norway. <i>Nordic Journal of Nursing Research</i> 2014;34(1):42-45.
Leila NM, Pirkko H, Eeva P, Eija K, Reino P. Training medical students to manage a chronic pain patient; both knowledge and communication skills are needed. <i>European journal of pain</i> 2006;10(2):167-170.
Mackintosh-Franklin C. The impact of experience on undergraduate preregistration student nurses' responses to patients in pain: a 2-year qualitative longitudinal study. <i>Pain management nursing : official journal of the American Society of Pain Management Nurses</i> 2014;15(1):199-207.
Mackintosh-Franklin C. Pain: A content review of undergraduate pre-registration nurse education in the United Kingdom. <i>Nurse education today</i> 2017;48:84-89.
Mezei L, Murinson BB, Johns Hopkins Pain Curriculum Development T. Pain education in North American medical schools. <i>The journal of pain : official journal of the American Pain Society</i> 2011;12(12):1199-1208.
Morris H, Ryan, D. Lauchlan., Field, M. "Do medical student attitudes towards patients with chronic low back pain improve during training? a cross-sectional study." <i>BMC Medical Education</i> 2012;12:10.
Murinson BB, Gordin V, Flynn S, Driver LC, Gallagher RM, Grabis M, Medical Student Education Sub-committee of the American Academy of Pain M. Recommendations for a new curriculum in pain medicine for medical students: toward a career distinguished by competence and compassion. <i>Pain Med</i> 2013;14(3):345-350.
Murinson BB, Nenortas E, Mayer RS, Mezei L, Kozachik S, Nesbit S, Haythornthwaite JA, Campbell JN. A new program in pain medicine for medical students: integrating core curriculum knowledge with emotional and reflective development. <i>Pain Med</i> 2011;12(2):186-195.
Niemi-Murola L, Nieminen JT, Kalso E, Poyhia R. Medical undergraduate students' beliefs and attitudes toward pain: how do they mature? <i>European journal of pain</i> 2007;11(6):700-706.
Plaisance L, Logan C. Nursing students' knowledge and attitudes regarding pain. <i>Pain management nursing : official journal of the American Society of Pain Management Nurses</i> 2006;7(4):167-175.
Puljak L, Sapunar D. Web-Based Elective Courses for Medical Students: An Example in Pain. <i>Pain Medicine</i> 2011;12(6):854-863.
Rahimi-Madiseh M, Tavakol M, Dennick R. A quantitative study of Iranian nursing students' knowledge and attitudes towards pain: implication for education. <i>International journal of nursing practice</i> 2010;16(5):478-483.
Rochman DL. Students' knowledge of pain: a survey of four schools. <i>Occupational Therapy International</i> 1998;5(2):140-154.
Rochman DL, Sheehan MJ, Kulich RJ. Evaluation of a pain curriculum for occupational therapists: experiences from a master's-level graduate program over six years. <i>Disability and rehabilitation</i> 2013;35(22):1933-1940.
Ryan C, Murphy D, Clark M, Lee A. The effect of a physiotherapy education compared with a non-healthcare education on the attitudes and beliefs of students towards functioning in individuals with back pain: an observational, cross-sectional study. <i>Physiotherapy</i> 2010;96(2):144-150.
Scudds RJ, Scudds RA, Simmonds MJ. Pain in the physical therapy (pt) curriculum: a faculty survey. <i>Physiotherapy Theory and Practice</i> 2001;17(4):239-256.
Shaw S, Lee A. Student Nurses' Misconceptions of Adults with Chronic Nonmalignant Pain. <i>Pain Management Nursing</i> ;11(1):2-14.
Stevens DL, King D, Laponis R, Hanley K, Zabar S, Kalet AL, Gillespie C. Medical students retain pain assessment and management skills long after an experiential curriculum: a controlled study. <i>Pain</i> 2009;145(3):319-324.
Strong J, Meredith P, Darnell R, Chong M, Roche P. Does participation in a pain course based on the International Association for the Study of Pain's curricula guidelines change student knowledge about pain? <i>Pain research &amp; management</i> 2003;8(3):137-142.
Strong J, Tooth L, Unruh A. Knowledge about pain among newly graduated occupational therapists: relevance for curriculum development. <i>Canadian journal of occupational therapy Revue canadienne d'ergotherapie</i> 1999;66(5):221-228.
Tellier PP, Belanger E, Rodriguez C, Ware MA, Posel N. Improving undergraduate medical education about pain assessment and management: a qualitative descriptive study of stakeholders' perceptions. <i>Pain research &amp; management</i> 2013;18(5):259-265.
Turner GH, Weiner DK. Essential components of a medical student curriculum on chronic pain management in older adults:

results of a modified delphi process. <i>Pain Med</i> 2002;3(3):240-252.
Twycross A. Education about pain: a neglected area? <i>Nurse education today</i> 2000;20(3):244-253.
Unruh A. Teaching student occupational therapists about pain: a course evaluation." <i>Canadian Journal of Occupational Therapy</i> . <i>Canadian Journal of Occupational Therapy</i> 1995;30-36.
Voshall B, Dunn KS, Shelestak D. Knowledge and attitudes of pain management among nursing faculty. <i>Pain management nursing : official journal of the American Society of Pain Management Nurses</i> 2013;14(4):e226-235.
Watt-Watson J, Hunter J, Pennefather P, Librach L, Raman-Wilms L, Schreiber M, Lax L, Stinson J, Dao T, Gordon A, Mock D, Salter M. An integrated undergraduate pain curriculum, based on IASP curricula, for six health science faculties. <i>Pain</i> 2004;110(1-2):140-148.
Watt-Watson J, McGillion M, Hunter J, Choiniere M, Clark A, Dewar A, Johnston C, Lynch M, Morley-Forster P, Moulin D. A survey of prelicensure pain curricula in health science faculties in Canadian universities. <i>Pain Research and Management</i> 2009;14(6):439-444.
Watt-Watson J, Peter E, Clark AJ, Dewar A, Hadjistavropoulos T, Morley-Forster P, O'Leary C, Raman-Wilms L, Unruh A, Webber K, Campbell-Yeo M. The ethics of Canadian entry-to-practice pain competencies: how are we doing? <i>Pain research &amp; management</i> 2013;18(1):25-32.
Weiner DK, Morone NE, Spallek H, Karp JF, Schneider M, Washburn C, Dziabiak MP, Hennon JG, Elnicki DM, University of Pittsburgh Center of Excellence in Pain E. E-learning module on chronic low back pain in older adults: evidence of effect on medical student objective structured clinical examination performance. <i>Journal of the American Geriatrics Society</i> 2014;62(6):1161-1167.
Wilson JF, Brockopp GW, Kryst S, Steger H, Witt WO. Medical students' attitudes toward pain before and after a brief course on pain. <i>Pain</i> 1992;50(3):251-256.
Zalon ML. Pain management instruction in nursing curricula. <i>The Journal of nursing education</i> 1995;34(6):262-267.



Table 2. Proposed problems, and suggested solutions to improve pain education

	<b>PROPOSED PROBLEMS</b>	<b>SUGGESTED SOLUTIONS</b>
<b>DESIGN</b>	<p>There is a lack of time spent on pain education. It is not always visible in health curricula or explicit where pain is being taught.</p> <p>There is often poor stakeholder engagement in curricula design with a lack of standards from policy makers and health regulators.</p> <p>The psychosocial aspect of the biopsychosocial model is not as well covered as the bio aspect. Student attitudes and beliefs about pain, and 'other' factors such as prior experience with pain is often not considered or incorporated into pain education.</p>	<p>Redesign curricula with increased focus on pain. Make it explicit where pain education features in curricula. Use profession specific or interprofessional curricula outlines.</p> <p>Where possible include patients, students, and educators in the design of pain education. Ask health regulators to mandate pain education.</p> <p>Challenge student attitudes and beliefs. Consider incorporating education on values, empathy and ethics. Include education on interpersonal skills such as listening and communication when educating students about pain.</p>
<b>DELIVERY</b>	<p>Traditional pedagogic approaches such as lectures may not be effective in improving pain knowledge and skills, or influencing attitudes and beliefs about pain.</p> <p>Knowledge, skills, attitudes and beliefs about pain in faculty educators are not always considered.</p>	<p>Use pedagogic approaches with proven outcomes e.g. interprofessional, e-learning, short courses. Locate pain education in real clinical practice settings.</p> <p>Challenge attitudes and beliefs. Educate the educators. Identify local pain champions.</p>
<b>OUTCOME</b>	<p>Translating pain education into pain practice is challenging. Health professionals are not always thought to be competent or confident in pain practice on graduation.</p> <p>There is lack of research that incorporates patients, or focusses on patient outcomes.</p>	<p>Increase the uptake of competency based outcomes and frameworks at both the pre-registration/pre-licensure stage of training, and in continuing professional development.</p> <p>Expand methodologies to advance pain education research. Where possible include patients, students, educators in the evaluation of pain education.</p>