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# BMJ Open

## How effective is undergraduate palliative care teaching for medical students? A systematic literature review

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# How effective is undergraduate palliative care teaching for medical students?

## A systematic literature review

**Running head:** Palliative care teaching for medical students

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## Abstract

Palliative care is central to the role of newly qualified doctors, and most experienced doctors. There is variability in the amount and type of teaching about palliative care at undergraduate level. Time allocated for such teaching within the undergraduate medical curricula remains scarce. Given this, the effectiveness of palliative care teaching needs to be known.

**Objectives:** To evaluate the effectiveness of palliative care teaching for undergraduate medical students.

**Design:** A systematic review (PROSPERO registration CRD42018115257) was prepared according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidance. Screening, data extraction, and quality assessment (mixed methods and Cochrane risk of bias tool) were performed in duplicate.

**Data Sources:** Embase; MEDLINE; PsycINFO; Web of Science; ClinicalTrials.gov; Cochrane, and grey literature in August 2019. Studies evaluating palliative care teaching interventions with medical students were included.

**Results:** 1283 titles/abstracts and 101 full text articles were screened. 19 studies were included with 3253 participants. 17 of the varied methods palliative care teaching interventions improved knowledge outcomes. The effect of teaching on clinical practice and patient outcomes was not evaluated in any study.

**Conclusions:** The majority of palliative care teaching interventions reviewed improved knowledge of medical students. The studies did not show one type of teaching method to be better than others, and thus no “best way” to provide teaching about palliative care was identified. High quality, comparative research is needed to further understand effectiveness of palliative care teaching on patient care/clinical practice/outcomes in the short and longer term.

### Article Summary: Strengths and limitations of the review

- This was a rigorously conducted systematic review including “grey” literature and evaluating the quality of the individual included studies.
- Studies using objective measures of assessment were included; with studies only reporting subjective assessments, self-reports and opinions of participants being excluded. Studies using external ratings as assessment of students were included.
- Even using a systematic approach, it remains possible some studies might have been missed.
- Publication bias is possible, as studies yielding negative results are less likely to be published and, although ‘grey’ literature was searched, this may not have fully captured unpublished works.
- In view of the variability in interventions and outcomes between included studies, a meta-analysis was not possible.

### Keywords:

Palliative care; palliative medicine; hospitals, teaching; teaching; systematic review; education, medical; education, medical, undergraduate.

## BACKGROUND

Palliative care is the holistic care of people with advanced, incurable illnesses, and their families.<sup>1</sup> The spectrum of patients receiving palliative care is wide reaching, and ranges from care at the point of incurable illness diagnosis, to the care of dying patients.<sup>1</sup> Palliative care is interdisciplinary in nature and involves: symptom control; information sharing with patients; advance care planning; coordination of interdisciplinary input; and care for the families of patients.<sup>2</sup> The literature informs us these are the key areas which are deemed important to patients when diagnosed with an advanced and incurable illness.

Medical students and doctors require the appropriate knowledge, skills and attitudes to care for patients who have an advanced and incurable illness. For example, in the United Kingdom, it is estimated in their first year of working, newly qualified Foundation Year 1 (FY1) doctors will care for approximately 40 patients who will die, and a further 120 patients who are in the last months of life.<sup>3</sup> The ability to care for, and communicate appropriately with these patients and their families is an essential skill for all doctors.<sup>4</sup>

Current medical curricula are saturated,<sup>5</sup> and competition for teaching time is fierce. There is an increased drive to incorporate palliative care teaching into medical schools,<sup>6</sup> in the hope to improve care for patients. Greater integration of palliative care teaching represents the acknowledgment that care of these patients and those who are dying has room for improvement. Furthermore, an aging, multimorbid population and a growth in the diversity of palliative treatment options also contribute to the surge in recognition of palliative care's importance.<sup>7, 8</sup> Given this increased drive to incorporate palliative care teaching, we need to ensure there is an evidence-base around its effectiveness as justification for its inclusion and/or how to best use this time. Despite this, no contemporary examination of palliative care-related teaching methods exists. The efficacy of various methods has not been recently evaluated, and it is therefore difficult to conclude which methods infer the most benefit upon medical students.

## AIM

The overall aim of this review was to evaluate the effectiveness of palliative care teaching upon medical students.

## METHODS

This systematic review was designed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Protocol 2015 guidance,<sup>9</sup> and registered with International Prospective Register of Systematic Reviews (PROSPERO, CRD42018115257). It is reported according to PRISMA guidelines.<sup>10</sup>

### *Search strategy*

A search and associated terms were developed with an information science specialist to determine the best search strategy. Studies of palliative care teaching were searched using the terms “palliative care,” “medical student,” and “teaching”. To increase sensitivity, Medical Subject Headings (MeSH) terms and free text terms were used in searches using the electronic databases Embase (Ovid); Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations; PsycINFO (Ovid); Conference Proceedings Citation Index–Science (Web Of Science; Thomson Reuters, New York City, NY); ClinicalTrials.gov (US NIH); ISRCTN registry (BMC); Cochrane Database of Systematic Reviews (Wiley); Cochrane Central Register of Controlled Trials (Wiley); and Health Management Information Consortium (HMIC) (Ovid). Searches were also conducted for grey literature using the following online databases: the Bielefeld Academic Search Engine (BASE) (<https://www.base-search.net/>), OpenGrey (<http://www.opengrey.eu/>), and Mednar (<https://mednar.com/>). The Embase search strategy is included as a supplementary file. Search strategies from all other databases are available on request from the authors. Searches were carried out on 06/08/2019.

Reference lists of relevant articles (included studies and reviews) were hand searched.<sup>11</sup> Authors’ personal files were also searched to make sure that all relevant material has been captured. Finally, we circulated a bibliography of the included articles to the systematic review team, as well as to scholarship palliative care clinicians’ experts identified by the team, to ensure any relevant literature was not missed.



### **Eligibility criteria**

Studies evaluating a palliative care teaching intervention directed towards medical students were included (Table 1). Where there were mixed study populations and data, studies were only included if data on medical students could be individually extrapolated. To be included, studies needed to demonstrate an objective measure of knowledge or skills; studies with only self-opinion/self-perspective, reflective essays and qualitative outcomes were excluded.

Titles/abstracts and full-text papers were independently screened against pre-defined eligibility criteria (table 1) by two reviewers (J.B. and either A.D./M.B.). Disagreement at all stages was resolved by consensus and/or with a third reviewer (either J.B., A.D./M.B.). The results of the searches were shown in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1).

**Table 1: Eligibility criteria for inclusion or exclusion based on key study criteria.**

<b>Study Design:</b>	
Inclusion:	Exclusion:
Qualitative and quantitative studies, randomized studies, non-randomised studies, cluster studies, before and after studies, cohort studies, observational studies, case-control studies and narrative research studies.	Case studies. Opinion pieces (commentaries, letters, editorials).
<b>Participants:</b>	
Studies in medical students. There were no exclusions based on age or course type.	
<b>Interventions:</b>	
Studies of any type education were considered for inclusion. This included but was not limited to Online (lectures, videos, quiz), workshops, lectures, small group teaching, bedside teaching, reflection, reflective essays.	
<b>Comparators:</b>	
Any comparators were considered for inclusion. Likely to be no, different, or less education.	
<b>Outcomes:</b>	

Any outcome measure assessing the effectiveness of palliative care learning and teaching. These might relate to competence/skills, and/or knowledge, and include but not limited to, exam scores.	Studies with only student's self-opinion/self-perspective, reflective essays and qualitative outcomes were excluded as the primary interest was objective measures of effects of palliative care teaching interventions.
<b>Timing:</b>	
No restrictions on length of follow up after the teaching was delivered to medical students.	
<b>Setting:</b>	
No restrictions by country or education setting (providing it was to medical students).	
<b>Date:</b>	
Be no restrictions by date.	
<b>Language:</b>	
No language restrictions for searching studies. Non-English language papers were included in the review and every attempt was made to translate all included foreign language papers. However, if translation was not possible, this was recorded.	
<b>Publication status:</b>	
Published as well as unpublished work was searched for and considered for inclusion. If only an abstract was available, the authors were contacted to attain further information from their study.	

### **Data extraction**

Data were extracted in duplicate (J.B. and either A.D./M.B.) for the aim, study setting, design, population included, educational intervention and comparator, assessment method used, outcomes, Kirkpatrick Model level,<sup>12</sup> study quality, strengths/limitations and ideas for further research (determined by the study authors and reviewers) onto pre-prepared templates.

### **Quality assessment**

The methodological quality of each study was independently assessed by at least two reviewers (JB and either AD/MB). The mixed methods tool (MMAT) was used if the study was mixed methods<sup>13</sup> and Cochrane risk of bias tool was used if a study was quantitative.<sup>14</sup>

### ***Data analysis and synthesis***

Due to the heterogeneity of results, a narrative data synthesis was performed. A team of researchers were involved in the synthesis and development of themes, and analysis of potential biases and quality. Four stages took part with all members of the research team: (1) development of a theoretical model, (2) preliminary synthesis, (3) exploration of relationships in the data (4) and assessing the robustness of the final synthesis.<sup>15</sup>

### **Patient and Public Involvement**

No patient involved in this systematic review.

## **RESULTS**

The search identified 1283 titles and abstracts for initial screening against the study's eligibility criteria. Following this, 101 full text articles were screened in detail for eligibility. 19 studies were included. The total number of participants in the 19 studies was 3595, data were gained and used from 3253 participants, with long-term follow-up data (up to 1 year) in 274 participants (from 3 studies). The number of participants in the included studies ranged from 40 to 670; with a mean of 171.2 participants per study (table 2).

### ***Quality appraisal***

The quality of mixed methods studies were assessed using MMAT (n=11),<sup>13</sup> and purely quantitative studies using a trial type of methodology were assessed using Cochrane risk of bias tool (n=8).<sup>14</sup> Overall the 11 mixed method studies included met all required components of quality using the mixed methods tool (table 2). The Cochrane risk of bias tool, which has more stringent criteria, showed a range of bias; 1 was high risk of bias, 5 were medium risk of bias and 2 were low risk of bias (table 2).

Table 2: Data extraction table

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Auret 2008 Australia	Identify if a structured clinical instruction module improves students self-rated confidence	Pre & post- test design.	91 6 <sup>th</sup> year medical students  (91/106 students: response rate=86%)  Follow-up questionnaire at end of academic year: 30/109 students (response rate=28%)	2 hour Structured Clinical Instruction Module - nine 15minute stations. 4 groups of 30-35 students (in groups of 4).  Taught by 1 palliative care consultant + team of nurses/doctors/ pharmacist	Acted as own comparator, pre- & post test	Questionnaire – 6-point Likert scale. Pre workshop, immediately post workshop + follow-up at end of academic year	Improved knowledge and skill post workshop. Poor rate of completion of follow-up, but sustained improvement.	2a	Assessed using Cochrane risk of bias tool, medium risk of bias. Risk of attrition bias- 86% initial completion rate dropped to 28% completion at end of academic year. Reasons not fully explored.	Strengths- required less facilitators than some other interventions, 'practical feel'. Limitations- no statistical reporting, poor response to longer-term follow-up minimising evaluation of knowledge retention.	To formally test kn
Brand 2012 Australia	Evaluate students' knowledge, attitudes and experience of a palliative care education programme in a graduate entry medical setting	Pre & post- test design knowledge and Self-Efficacy in Palliative Care	62 2 <sup>nd</sup> year graduate med students. 40/62 (64.5%) completed both the pre- and the post-test  Taught by 4 palliative care consultants + 4 registrars	8 hours palliative teaching within 100-hour oncology curriculum. 5 week oncology/ palliative care block. Lectures, PBL sessions, bedside/clinic tutorials, visit to inpatient unit, self-directed reading.	Acted as own comparator, pre-test & post test	Multiple choice question knowledge test, 2 validated attitudinal scales, student feedback survey (Likert scale + open ended questions)	No statistical significance in mean improvement in knowledge. Subset statistical improvement in symptom management (p=0.001). improvements in attitudes towards communication, symptom management and MDT care	2b	Assessed using mixed methods tool- passed all components.	Strengths: Mixed methods study. Limitations: Possible selection bias – only 64.5% completed pre and post tests and 42% response rate to student evaluation questionnaire, multiple choice questions weren't independently validated.	No
Brownfield 2009 USA	Examine the feasibility of a 1-week palliative care course incorporated into the medicine clerkship; knowledge and	Pre & post- test design	84 Third year medical students.  53/84 (63%) students completed both pre- and post-tests	1-week palliative care curriculum during a 1-year period. Included in-patient and out-patient care, MDT rounds, reflection and didactic teaching around core clinical topics.	Acted as own comparator, pre-test & post test	Survey of attitudes towards palliative care and pre- and post-course measurements of knowledge.	Statistically significant improvement in knowledge scores (pre-course mean scores 145/230 and 175/230 post-intervention (P<0.01). Improved attitudes.	2b	Assessed using mixed methods tool- passed all components.	Strengths- mixed methods study. Limitations- 63% response rate even to knowledge tests- response bias.	No

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	attitudinal changes in students who had completed the course.										
Chang 2009 Taiwan	Evaluate the effect of a multimodal teaching program on preclinical medical students' knowledge of palliative care and their beliefs relating to ethical decision-making.	Pre & post- test design	118 third year medical students- 'pre-clinical' in Taiwan as medicine is a 6-year degree. Voluntary participation.  Taught by palliative care doctors, clinical social workers, chaplain, nurse practitioner/nurse lead for palliative care.	1 week, end of life care curriculum developed. 3 learning modules. Included bedside teaching, lecture series and small group discussion.	Acted as own comparator, pre-test & post test	Assessed knowledge + beliefs regarding decision making. Instrument constructed based on literature review and national guidance. Validated for use by content expert and tested for reliability-items not meeting reliability statistical cut off excluded.	Improved knowledge following intervention by 14.7% (p<0.001). Clinical management knowledge improved the most. Some improvement in beliefs regarding decision making but not universal.	2b	Assessed using Cochrane risk of bias tool- Medium risk of bias. Selection bias likely to be present- students were volunteers, risking self-selection bias. 100% response rate- no attrition bias.	Strengths- validated test tool.  Limitations- only 18/32 knowledge items reliable enough for inclusion. Knowledge questions were true/false/not sure. Follow up immediately after intervention, not testing long-term retention of knowledge.	None discussed
Day 2015 USA	Compare the effect of eLearning versus small-group learning	Quasi-randomized controlled trial of web-based interactive education (eDoctoring) compared to small-group education (Doctoring)	119 Third year medical students. eDoctoring (n = 48) or small-group Doctoring (n = 71).	Interactive e-learning: eDoctoring on palliative care clinical content over two months.  No faculty input whilst taking the course.	26 Small group sessions on palliative/end of life care.  Small group teaching for 3 hrs on communication skills.	Pre-test and post-test questionnaires. 27 self-efficacy questions-rating confidence. 6 single best answer	Both groups- knowledge questions improved post-test, non-statistical trend present favouring the eDoctoring students. in self-efficacy ratings in both intervention and control, with no differences in	2b	Assessed using Cochrane risk of bias tool. Medium risk of bias. Quasi-randomised, low selection bias. Attrition bias possible- more dropouts in Doctoring arm (results excluded	Strengths- quasi-randomised Limitations-. No long-term measures in knowledge retention. Randomisation did not include technology fluency or viewpoints.	No

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
				Small group teaching for 3 hrs on communication skills. Yearlong course.	Yearlong course (same as intervention arm).	knowledge questions relating to curriculum covered by modules completed in eDoctoring.	improved between the groups.		from analysis) - reasons not explored.		
Dorner 2014 Germany	Explore the feasibility of peer teaching for communication skills training.	Pre & post- test study	37/49 (76%) medical students in in the fourth to sixth of medical school. Voluntary participation open to all medical students  Tutors- Fifth & sixth year medical students trained by faculty to deliver teaching.	90-minute peer taught workshop teaching 9 core communication skills regarding palliative and end of life care, particularly within the intensive care unit. Case based discussions and role play both used.	Own comparator, pre-test & post test	External 'intensivist' rated students based on a taped role play they conducted with another student. Qualitative analysis of transcripts to see how students spoke about death. Self-rated skills scores.	Self-rating scores improved following intervention (P<0.001). Mean expert ratings did not differ from student's own assessment of performance or skills except in one domain	2b	Assessed using mixed methods tool- passed all points.	Strengths- peer teaching affordable and easily scalable. Limitations- lacks long term evaluation	Further work required 'death'.
Ellman 2016 USA	Evaluate four-year curriculum in palliative care.	Mixed-method evaluation	First to fourth year medical students. 95 students in the implementation year	4-year longitudinal, integrated curriculum. Included workshops, hospice experience, modules, communication skills and a year 4 palliative care observed structured clinical examination (OSCE) station. 2 hours in 1 <sup>st</sup> year; 4 hours in 2 <sup>nd</sup> year; 15-23 hours in 3 <sup>rd</sup> year; 4 hours in 4 <sup>th</sup> year.	Comparator only for graduating student surveys- compared with national Association of American Medical Colleges questionnaire of US medical schools	Competency in a palliative care OSCE station at the end of the curriculum. Analysis of student written reflections. Graduating student surveys- regarding	In implementation year, average score 74% in OSCE palliative care station- lower than average score for other OSCE stations (84%) but felt to be 'acceptable'. Students undertaking 4-year curriculum felt more prepared in palliative care compared with other US medical schools.	2b	Assessed using mixed methods tool- passed all points.	Strengths: mixed methods study, curriculum is well integrated and longitudinal. Limitations- no long term follow up data, OSCE station on palliative care scored lower still than OSCE stations on other subjects	In order to evaluate a survey of former st

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Gerlach 2015 Germany	Evaluate the effects of the Mainz undergraduate palliative care education (UPCE) on students' self-confidence regarding important domains in palliative care.	Prospective questionnaire-based cohort study with a pre-post design. Knowledge test only at end of module	329 Fifth year medical students. All students took knowledge test.  156 (47%) students completed matched surveys at both points of measurement  Facilitators: physicians, palliative care nurses, bereaved family members.	Mandatory palliative care module over one term. 7x90 minute sessions. Included pain lecture hospice home care through use of videoed live interview with bereaved family member. Small group discussion.	Knowledge scores: historic test scores from before the intervention within Mainz examined- same test so comparison is likely acceptable. Self-confidence scores, comparison with cohort from 2011 in Mainz who did not receive module.	Multiple choice electronic knowledge exam after module- 21 item, single best choice answer. Pre and post testing of students' self-confidence.	All passed knowledge exam, average scores >90%. Compared to historic cohort: increased in correct answers for pain (40%), symptom control (69%), and psychosocial knowledge (33%). Self-reported confidence improved.	2b	Assessed using Cochrane risk of bias tool. Medium risk of bias. Attrition bias: 47% of surveys matched for pre-and post-test results, so data lost. Reasons are clear- incomplete form completion, effect of this is unclear.	Strengths- Intervention acceptable, enjoyed interdisciplinary input. Limitations: only 47% of surveys pre and post intervention matched and used (due to local policy), unknown if increases in knowledge and self-confidence are linked.	Whether or not the effect- research un... Further research ne...
Goldberg 2011 USA	To assess the effect of a required clinical rotation in palliative medicine	Historical control trial.	117 Fourth year medical students (month prior to graduation)  Taught by 2 interdisciplinary teams, each with an: attending physician, fellow in palliative med/geriatrics /oncology, a nurse practitioner, & a social worker staff (clinical team portion) + social worker, chaplain, & massage therapist	N=59 (51% of students from class of 2008) Addition of a required 1-week clinical rotation in palliative medicine (integrated in 12-week IM-Geriatrics clerkship) – multiple venues, time spent with consult team + formal didactic lectures on palliative care issues	N=58 (55% of students from class of 2007) = historical control group (received didactics but no clinical rotation in palliative medicine)	Survey: self-rated skills performance & interest, student educational experience, 30-question MCQ exam  2008 cohort also had 2 open-ended questions	No statistical difference in mean scores for knowledge questions  Higher skills self-ratings in 2008 cohort  Association of American Medical Colleges questionnaire: 2008 cohort more experience in palliative care	2b	Assessed using mixed methods tool- passed all points.	Strengths: mixed-methods study, utilised historical control group  Limitations: Diversity of exposure with clinical rotations, not controllable	Further research in applied  Exploring different rotations

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Green 2010 USA	Pilot study evaluating the effectiveness of a computer- based decision aid for teaching medical students about advance care planning.	Prospective, randomized controlled design	133 Second year medical students.  121/133 (91%) of students agreed to have their data used in study - 60 in the Decision Aid Group and 61 in the Standard Group.	Computer based decision aid for student use to help patients with advanced care planning (to help patient complete advance directive). Multimedia tool, uses educational material and exercises to help patient clarify values and priorities, help students explain end of life conditions and treatments and then helps synthesise this into an advance directive.	Prior to intervention all students received instruction in advanced care planning- lectures, reading material, small group discussion.	Knowledge assessed using a 17- item true/false and MCQ. Self- rated satisfaction, confidence and perceived knowledge of patient wishes. Patients' evaluation of student assessed using 12- items addressing students' communicati on skills, helpfulness, and perceived understandin g of their wishes. Patients' satisfaction assessed by	High baseline knowledge for advance care planning. Students in decision aid group more improved (84% to 88%, p<0.01) Student confidence increased following interventions in both groups but more in decision aid group. Student satisfaction higher in decision aid group. Patients significantly more satisfied with student performance and global impression in decision aid group.	3	Assessed using Cochrane risk of bias tool. High risk of bias. No discussion of how students were randomised so unclear if selection bias is present. patient bias- students were responsible for recruiting patients and these were eligible to be family/friends- patient rating scales may well be biased.	Strengths- tool easy to roll out and applicable within other institutions. High levels of student and patient satisfaction. Limitations- pilot study so not powered. Selection of patients determined by students. No full data regarding student interactions with patients, time spent. Confounding factors within this that could have impacted results. Measures used within the study not validated.	National study com approaches to adva



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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
						measure of global satisfaction					
Jackson 2002 USA	Evaluate a palliative medicine curriculum developed for medical students in the required third-year clerkship in family medicine at the University of Tennessee.	Pre & post- test design with the post-test assessment seven weeks later.	69 Third year medical students on their family medicine clerkship	Four-hour curriculum. Prior to session students were sent reading concerning palliative care. During session- discussion, role play, information giving via PowerPoint and lecture.	Acted as own comparator, pre-test & post test	20 item pre- test and post- test for palliative care knowledge. One item confidence question regarding palliative care clinical skills.	Significant knowledge gain post-test (37% pre-test to 55% post- test); (p<0.0001). Small but statistically significant increase in self-reported confidence (p=0.031).	2b	Assessed using Cochrane risk of bias tool. No bias noted in any domains. Low risk of bias.	Strengths-Popular with students on course evaluation-. Limitations- other palliative care education at institution.	long-term retention and the development measure the translational clinical skill sets.
Paneduro 2014 Canada	Develop and evaluate a pain management & palliative care seminar for medical students during surgical clerkship	Pre & post- test design with the post-test assessment at 1 year	292 Third & Fourth year medical students in surgical clerkship  95% (n=277) completed post- test immediately following the seminar and 31% (n=90) completed the follow-up test via e-mail.	4-hour seminar on pain management and palliative care  Taught by faculty from pain medicine, surgery & palliative care	Acted as own comparator, pre-test & post test	10-item knowledge test  Comments on seminar	Significant knowledge improved; maintained at 1 year. mean pre- test, post-test and one-year follow-up test scores were 51%, 75% and 73%, respectively.  No difference between 3 <sup>rd</sup> & 4 <sup>th</sup> year students	2b	Assessed using mixed methods tool- passed all points.	Strength: Relatively short items to respond to in order to facilitate participant, collaboratively designed seminar  Limitations: high attrition rate at 1 year. Hard to control for seminar impact specifically, at long-term follow-up	Modify seminar to
Poter-Williams 2004 USA	Assess impact of a hospice curriculum for medical students, in terms of knowledge,	Pre & post- test study	127 Third year medical students	32-hour, 4-day curriculum	Acted as own comparator, pre-test & post test	26-item self- assessment of competency, a 20-item self-report of concerns, a 50-item MCQ knowledge	23% improved knowledge 56% improved competence 29% improved for concerns (all p<0.0001). No changes for attitudes (p=0.35)	2b	Assessed using mixed methods tool- passed all points.	Strength: multiple measures of curricular evaluation, curriculum could be applied at other universities  Limitations: no long-term follow-up	link specific clinical explanation; longitu

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	skills, & attitudes					test, & qualitative assessment of course curriculum	(already had appropriate attitudes)				
Shultz- Quach 2018 German y	Evaluate an eLearning course "Palliative Care Basics" in terms of student acceptance, exam performance , and competence	Cross-sectional study	670 Undergraduate medical students (3 cohorts). 569 (96%) used eLearning as preparation for the exam; 23 did not.	eLearning course (5 teachings domains over 10 teaching units). Virtual patient contact, didactic teaching, e-lectures, patient case vignettes	Students who did not access the eLearning course. 23 students	Questionnaire of self- assessment  Course eval, with ratings and free response section  20-item MCQ exam	Knowledge improved (p=0.02). High approval of eLearning tool – easy to approach topics, increased interest,	2b	Assessed using mixed methods tool- passed all points.	Strength: Mixed- methods  Limitations: no baseline measurements, very small comparator group	Further assessment
Tai 2014 Australia	Assess whether a 1- week palliative care placement improves student performance & knowledge. Explore student views on palliative care rotation, particular for building confidence	Consecutive cohort Retrospective analysis, pre & post- test mixed methodology	84 Fifth year medical students (who enrolled in palliative care placement).  72 (86%) completing both pre- and post-course multiple- choice questions	1-week palliative care placement  Combination of didactic and interactive tutorials with experiential attachment such as ward rounds	Acted as own comparator, pre-test & post test/course	Knowledge based questions (16 MCQs)  Post-course satisfaction ratings (10- closed item questions + 2 open-ended questions)	Improved knowledge: average 58% to 74% (P<0.001).  Most reported value of course and wanted more palliative care education	2b	Assessed using mixed methods tool- passed all points.	Strength: mixed- methods.  Limitations: measures not validated; reduced sample size due to exclusion of students who did not complete both parts of study	Assess value of diff might not be enough
Tan 2013 Canada	Determine whether virtual patient case	Mixed methods pre & post- survey	137 Third year medical students	Virtual patient clinical case, mandatory exercise in family medicine rotation	Acted as own comparator, pre-test & post test	Knowledge test & level- of- preparedness	Knowledge scores increased (48-63%: p<0.001)	2b	Assessed using mixed methods tool- passed all points.	Strength: mixed- methods approach for evaluation	Expanding knowled changes in knowled

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	in palliative care could offer students acceptable alternative to real-life experiences		95% (130/137) consented to have their results analyzed. knowledge score assessed in 127	Average time spent with virtual patient case = 0.93 hours, SD=0.65		survey (self-assessment of clinical skills), plus student feedback on virtual patient case/usage & general feedback	virtual patient case was realistic (91%), and educational (86%)  Students spending >20 minutes on case reported more engagement			Limitations: hard to correlate time spent on case with outcomes, limited info about students' experiences with real patients	
Tsai 2008 Taiwan & China	Assess the impact of a 4-hour multimodule curriculum on knowledge & attitudes of end of life care	Prospective cross-sectional pre & post- test survey	259 Fifth year medical students	4-hour course included: 1 hour lecture by specialist, 1 hour patient visit at unit, 1 hour literature reading, 1 hour discussion	Acted as own comparator, pre-test & post test	Questions on knowledge, demographics & ethical beliefs	Knowledge improved (55% to 70%) (p<0.0001). Principles of palliative care scores improved (58% to 73%). Clinical management improved (59% to 68%)	2b	Cochrane risk of bias tool- Low risk of bias, no bias evident in any domains.	Strength: easy to implement curriculum. correlation analysis across items  Limitations: hard to control for confounding variables like maturation effect	Further assessment follow up studies  Longitudinal study
Tse 2017 USA	Explore the application of online learning tool with hospice experience	Randomised prospective pre & post study	152 Second year medical students completed the survey (response rate 51%)  56% (n=85) completed the online module	Addition of 30 min online module to hospice experience. Taught by hospice care physician or nurse ) in hospice setting	Randomised to receive module prior to hospice experience (YES module) versus after experience (NO module)	23-item electronic survey: 10 attitude-assessing statements from FATCOD, 8 multiple choice knowledge questions	Higher scores on knowledge questions for students completing the online module (p=0.006).  No statistical difference in attitudes	2b	Assessed using Cochrane risk of bias tool, medium risk of bias. self-selection bias as voluntary participation, could suggest already motivated regarding palliative care. Randomisation not described	Strengths- mixed methods study, focused on assessing blended learning experiences  Limitations: Single site study, survey was relatively few items	Expanding scope of  More survey items
Von Guten 2012 USA	Assess impact, retention, & magnitude of effect of a required	Prospective pre-post study	487 Third year medical students	Specified palliative care curriculum designed for 1 day/week for 4 weeks (during the ambulatory block of the 12-week IM clerkship)	Self-comparator over time (pre-test & post-test).	36-item knowledge test, self-assessment of competency,	Knowledge: improved 52% to 67% (national residents, average score 62%). 56% improved confidence (higher	2b	Assessed using mixed methods tool- passed all points.	Strength: mixed methods, assess various levels of effect, national comparison	None outlined by s

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	didactic & experiential palliative care curriculum			Taught by IM faculty. participation was compulsory	knowledge compared with national cross-sectional study comparing residents at progressive training levels	& self-assessment of attitudes + written surveys	than resident national averages). 29% decrease in concern. (All p<0.001).  All maintained at 1 year.			Limitations: evaluation instruments designed for specific learning objectives of course. Documentation of long-term follow-up unclear	

## ***Context of Included Studies***

### *Demographics*

The selected studies took part in many countries; 9 United States of America (USA), 3 Australia, 3 Germany, 2 Canada and 2 Taiwan (1 of which also included China).

### *Study designs*

14 of the included studies tested knowledge before and after a teaching intervention, in a pre-post design. The post-test was immediately post intervention in all but 4 studies, with one study conducting its post-test at seven weeks, and the other three at approximately 1-year post intervention. Most of these pre-post designed studies were cohort-type studies; one was randomised, and 3 included a mixed methods design. The other 5 included studies used a randomised controlled design, quasi-randomized controlled trial, historical control trial and 2 cross-sectional design studies (table 2).

### *Types of teaching interventions*

The included studies had a wide variety of teaching methods and teaching hours. The main shared descriptor of palliative care teaching interventions in the included studies was the duration. Studies could be largely summarized as 'small' scale teaching interventions (interventions with a duration of hours), or as 'large' scale teaching interventions (interventions that took place over the course of days). Included studies were categorized into these durations, and durations were decided comparatively by the researchers. In addition to these small and large interventions, a third descriptive category was determined: eLearning interventions. Because the nature of eLearning is often associated with uncertain measures of time (depending on student use outside of learning environment), eLearning interventions were considered to be different than small or large face-to-face teaching interventions. Given the variance in shared descriptors, the decision was made to synthesise results based on the type of intervention: small, large, or eLearning.

### *Different assessment methods*

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3 The studies used different assessment methods and some studies used multiple methods of  
4 assessment (table 2); this made it difficult to assimilate study outcomes. Most commonly,  
5 multiple choice questions (MCQs) were used to test knowledge<sup>16-22</sup> or a combination of  
6 MCQs and true/false questions.<sup>23</sup> The number of items testing knowledge differed between  
7 studies. These ranged from 6 single best answer items,<sup>24</sup> 8 MCQs<sup>25</sup> to 50 MCQs.<sup>21</sup> Other  
8 methods of assessments included an 'external intensivist' rating student performance based  
9 on a taped role play<sup>26</sup> and OSCE station assessment.<sup>27</sup> Some studies also assessed student  
10 attitudes and confidence in a pre-post format.<sup>17, 19, 22, 23, 25, 28, 29</sup>

## 21 **Synthesis of results**

### 23 *Smaller teaching interventions*

25 Seven of the included studies evaluated a 'small' palliative care teaching intervention; these  
26 included a range of interventions of different sizes, from 1.5 to 10.5 hours, with a median of  
27 4 hours.<sup>17, 18, 26, 30-33</sup> Six of the seven included studies showed improved knowledge  
28 assessment outcomes (table 2),<sup>18, 26, 30-33</sup> and one of these studies included a one-year  
29 follow-up, with knowledge retention demonstrated.<sup>31</sup> Although one study did not show  
30 overall improvement in knowledge scores, it did demonstrate improvements in symptom  
31 management scores in a subset analysis.<sup>17</sup>

### 39 *Larger teaching interventions*

41 Seven of the included studies evaluated a 'large' palliative care teaching intervention, with  
42 interventions ranging from 4 to 5 days, with a median of 5 days (table 2). Six of the seven  
43 large scale studies demonstrated improved knowledge assessment outcomes; although one  
44 of these had a poor comparator.<sup>27</sup> One study failed to demonstrate an improvement in  
45 knowledge compared to didactic teaching alone,<sup>16</sup> but there were critical limitations in the  
46 comparator used in the study by Ellman et al.<sup>27</sup> Ellman et al developed a new palliative care  
47 OSCE to assess student knowledge regarding symptom management, communication, and  
48 the psychosocial, spiritual, and cultural aspects of care. Competency in this OSCE station  
49 was deemed adequate by the authors (average score 74%) although the level attained at  
50 this station was below that of other OSCE stations; which was on average 84%.<sup>27</sup> There was  
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3 also no pre and post intervention testing, thus it is unclear if this intervention improved  
4 knowledge or not.  
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### 6 *eLearning teaching interventions*

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9 Five studies evaluated the effect of eLearning on knowledge in palliative care, with all these  
10 studies demonstrating a positive improvement in scores (table 2). The specific type of  
11 eLearning varied, but included: a virtual patient clinical case,<sup>34</sup> a computer-based decision  
12 aid for advanced care planning content,<sup>23</sup> a flipped classroom online module coupled with a  
13 hospice care experience,<sup>25</sup> and an eLearning course.<sup>20</sup> The fifth study, an Interactive e-  
14 learning course, is notable because it reported equivalence in increasing knowledge scores,  
15 when compared with small-group teaching sessions.<sup>24</sup> Of the eLearning studies included,  
16 this is the only one to provide a comparator to the eLearning resource. However, the study  
17 still considered the eLearning intervention to be 'successful,' as it was determined to be less  
18 faculty intensive to run but imparted the same degree of knowledge as 'traditional'  
19 teaching. Overall, all eLearning interventions offered flexibility for students.  
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### 30 *Summary*

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32 Overall, the majority (n=17) of the included studies demonstrated an improvement in  
33 knowledge. Small amounts of specific teaching improved knowledge in six out of seven  
34 studies. Similarly, large amounts of teaching improved knowledge in six out of seven studies.  
35 All eLearning interventions improved assessment outcomes in tests of knowledge. No  
36 included study directly compared small and large teaching interventions and, as study  
37 outcomes were heterogenous, it was not possible to evaluate whether small or large  
38 interventions were 'better.'  
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## 50 **DISCUSSION**

51 This systematic review presents a contemporary overview of the literature regarding the  
52 effectiveness of palliative care teaching to medical students. Significant heterogeneity of  
53 teaching approaches continues to exist, and is increasing, as new teaching methods (such as  
54 eLearning) develop and grow in popularity. Further contributing to the heterogeneity was  
55 the inconsistency of overall teaching approaches and methods of assessment in all included  
56 studies. This leads to the hypothesis that, regardless of the style of teaching, improvement  
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3 in palliative care knowledge scores is possible following effective instruction. Study designs,  
4 too, differed significantly, with no consistent approach to long term follow up. In view of the  
5 multifaceted heterogeneity evident in both study design and outcomes, the data gathered  
6 systematically were synthesised narratively.<sup>15</sup>  
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### 10 11 12 13 **Outcomes and constructive alignment considerations**

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15 Examining the intervention efficacy with an educational theory lens was the logical first step  
16 in performing a narrative synthesis of included articles in this particular review. One of the  
17 first theories to consider in any study measuring knowledge via assessment is Biggs' theory  
18 of constructive alignment.<sup>35, 36</sup> Constructive alignment argues that there needs to be  
19 alignment of learning outcomes, teaching methods, and assessment measures, otherwise,  
20 true learning may not occur. For example, if an educator presents learning outcomes to  
21 students related to palliative care, but then teaches a session on dermatology, and gives an  
22 assessment with questions concerning cardiology, you would expect students to not pass  
23 their assessment, and conclude learning did not occur. However, in this admittedly bizarre  
24 example, learning might have occurred; it just may have been related to palliative care, or  
25 most likely dermatology. Yet, because these educational components are not constructively  
26 aligned, it would be impossible to actually comment on learning. This same reasoning can be  
27 applied to the studies included in this review. Many studies determined learning occurred,  
28 as exemplified by improvement in knowledge scores. However, one issue when conducting  
29 this review was the inability to know with any certainty how related teaching and  
30 assessment were to one another. It was not made clear by the analysed studies how  
31 constructively aligned their assessment was to the palliative care teaching delivered. It was  
32 clear that some short interventions were geared to improve a specific aspect of palliative  
33 care (e.g. Advanced care planning),<sup>23</sup> but most larger interventions (where details were  
34 published and we could discern more exact content of the teaching), covered a range of  
35 topics in the palliative care curriculum. Poor detail regarding the content of assessment, and  
36 limited assessment regimens, makes it seem likely only some of these topics were formally  
37 assessed.  
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58 Failure to explicitly acknowledge constructive alignment within any of the included studies  
59 makes it difficult to accurately assess the efficacy of any (especially the large) teaching  
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3 interventions. Reproducibility of the value of the interventions will likely largely depend on  
4 specific variables relating to constructive alignment. Utilisation of constructive alignment in  
5 teaching intervention design and assessment may have been an influencing factor as to  
6 whether an intervention improved knowledge scores. However, without discussion of this in  
7 any of the studies, it is not possible to know whether constructively aligned learning  
8 outcomes, teaching and assessment is important to effective palliative care teaching.  
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### 17 **Impact of Teaching Interventions**

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19 Kirkpatrick's Four-Level Training Evaluation Model is used to evaluate the results of  
20 educational programs, which are divided into 4 levels (figure 2).<sup>12</sup> This model was used to  
21 evaluate the impact of interventions in the included studies.  
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24 Included studies in this review were mostly at level 2 of Kirkpatrick's Four-Level Training  
25 Evaluation Model; what students have learned.<sup>12</sup> The only study to assess Behaviour (Level  
26 3) was by Green et al<sup>23</sup> where patient satisfaction was evaluated in an advance directive  
27 scenario. This introduces the concept that for many of these teaching interventions, their  
28 potential efficacy has really only been assessed from a limited viewpoint. Although changes  
29 in knowledge and attitude are important, they do not guarantee the educational experience  
30 will change behaviour/practice. Measuring the clinical impact of a teaching intervention  
31 requires rigorous long-term follow-up, and such follow up was not performed by any studies  
32 within this review. Thus, no conclusions regarding the impact of these palliative care  
33 teaching interventions upon clinical practice or patient outcomes can be made. This is  
34 particularly important as with growing demands and need for quality palliative care in  
35 practice, it is important to understand if medical school interventions are actually improving  
36 later clinical practice, or long-term decisions of medical students. Studies suggest there are  
37 many misconceptions by lay and healthcare professionals of what palliative care is/hospices  
38 are, and thus one of the main aims of undergraduate teaching should be to try and dismiss  
39 this. This was not explored in any of the studies.  
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### 56 **Heterogeneity might indicate wide possibilities for curricular design**

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58 While the effect of palliative care teaching on clinical practice could not be elucidated from  
59 this review, there was significant information relating to potential knowledge gain and  
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3 exposure via palliative care teaching interventions. And, while there was significant  
4 heterogeneity in how knowledge was measured in these studies, interesting findings were  
5 identified. Both small amounts of specific teaching and larger scale interventions improved  
6 knowledge, which may support the argument that institutions should investigate integrating  
7 some level of teaching palliative care, even if small, as these can prove beneficial to the  
8 knowledge base for students. This is also supported by the fact that in these studies,  
9 regardless of teaching style as well, improvement in palliative care knowledge scores was  
10 possible following effective instruction. Again, this provides more evidence that while there  
11 seems to be no identifiable 'best practice' for teaching palliative care in medical education  
12 (as no studies compared this or asked this question, and knowledge scores used by different  
13 studies was not the same), this means that institutions can adapt from a variety of methods  
14 that may work best for their curriculum.

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16 eLearning also appeared to improve knowledge scores in studies included in this review.  
17 One study demonstrated the potential value of integrated eLearning with existing clinical  
18 experiences; a small, online module provided to students prior to a hospice experience  
19 demonstrated improved knowledge for these students.<sup>25</sup> This study, and the others relating  
20 to eLearning, contribute to the possibility that any type of palliative care teaching may be  
21 very beneficial, even with the need for more focused and detailed research.

### 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 **Limitations of included studies**

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41 The main limitation of the included studies is that none assessed effect upon clinical  
42 practice and patient outcomes. Thus, the effect on clinical practice of each teaching  
43 intervention is unknown. Only 3 studies undertook follow-up and collected long-term data;  
44 this was on 274 students. Thus, only a small portion of participants are represented in this  
45 data. 'Long-term' in this sense encompasses follow up within one year. No studies provided  
46 follow up data beyond this point, a limitation of all included studies. None of the included  
47 studies compared the impact of small vs large scale interventions, meaning that, although  
48 most interventions were effective, it is unknown whether large- or small-scale teaching or  
49 eLearning interventions are more effective in instilling palliative care knowledge.  
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### Future work

Our review highlights the need for future research to evaluate the differential impact of small and large interventions, whether interventions elicit behavioural changes, and the impact of teaching upon clinical practice during long-term follow-up. Impact of teaching upon patient care also requires study and could be based on markers of clinical assessment, management, and patient/family feedback.

### Conclusions

Most types of palliative care teaching interventions conducted with medical students improve knowledge. This provides useful information for medical schools when considering the teaching they currently provide, or aim to provide, in the future. The effect of undergraduate palliative care teaching on clinical practice has not been studied and warrants investigation. For all teaching approaches, constructive alignment and the communication of constructive alignment in educational studies should be considered to ensure adequate teaching impact. Further research into palliative care teaching should explicitly detail this alignment to allow for evaluation as to whether constructive alignment, not the teaching method, may be responsible for any effect of palliative care teaching interventions.

Medical students can learn about palliative care using a variety of methods; there is no definitive 'best' way to learn about palliative care. We have the responsibility to not just train medical students to pass exams, but to be safe and knowledgeable doctors. Given this, future research needs to assess the effect of teaching on clinical practice, including some analysis of patient related outcomes, in order to discern the real-world impact of palliative care teaching interventions.

### **Contributors**

JWB designed the study, performed the searches, led on data collection, data analysis and drafted the article. MELB and AND contributed to data collection, data analysis and writing of the article. JG and GMF contributed to study design, analysis and writing of the article. All authors were responsible for approval of the final report.

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### **Conflict of interest**

All authors declare that there are no conflicts of interest.

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4 into assessment-driven student learning gains in large-scale undergraduate microbiology  
5 courses. *Journal of microbiology & biology education*. 2013; 14: 12-24.  
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3 **Figure legends**  
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5 **Figure 1: PRISMA flow diagram**  
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8 **Figure 2: Kirkpatrick's Four-Level Training Evaluation Model.** Reproduced from (38).  
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Embase	362
Ovid MEDLINE	645
PsycINFO	209
Web of Science	211
ClinicalTrials.gov	0
ISRCTN registry	0
Cochrane Database of Systematic Reviews (protocols)	5
Cochrane Database of Systematic Reviews	29
Cochrane Central Register of Controlled Trials	21
Health Management Information Consortium (HMIC)	24
Bielefeld Academic Search Engine (BASE)	321
OpenGrey	4
Mednar	20

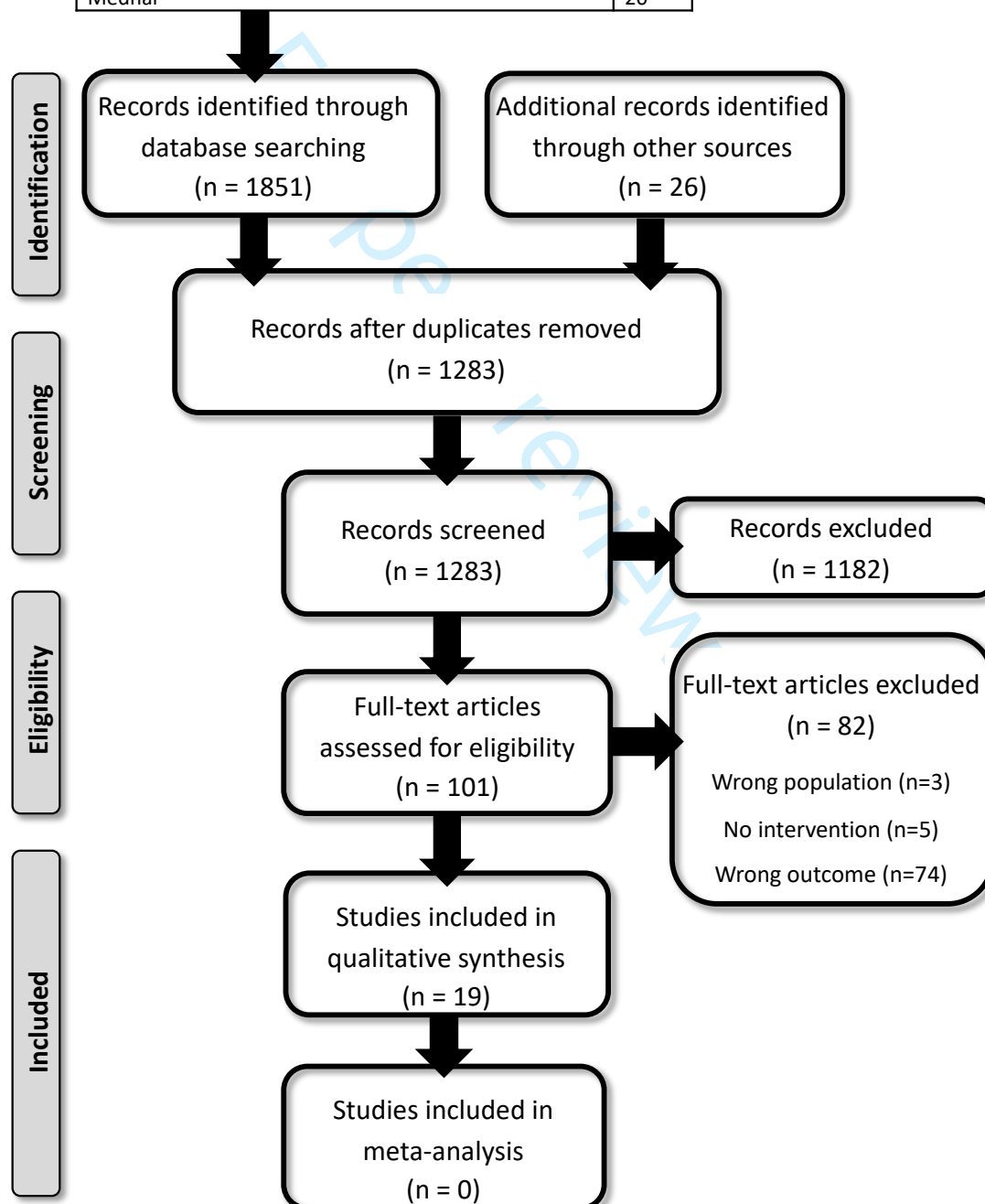


Figure 1: PRISMA flow diagram

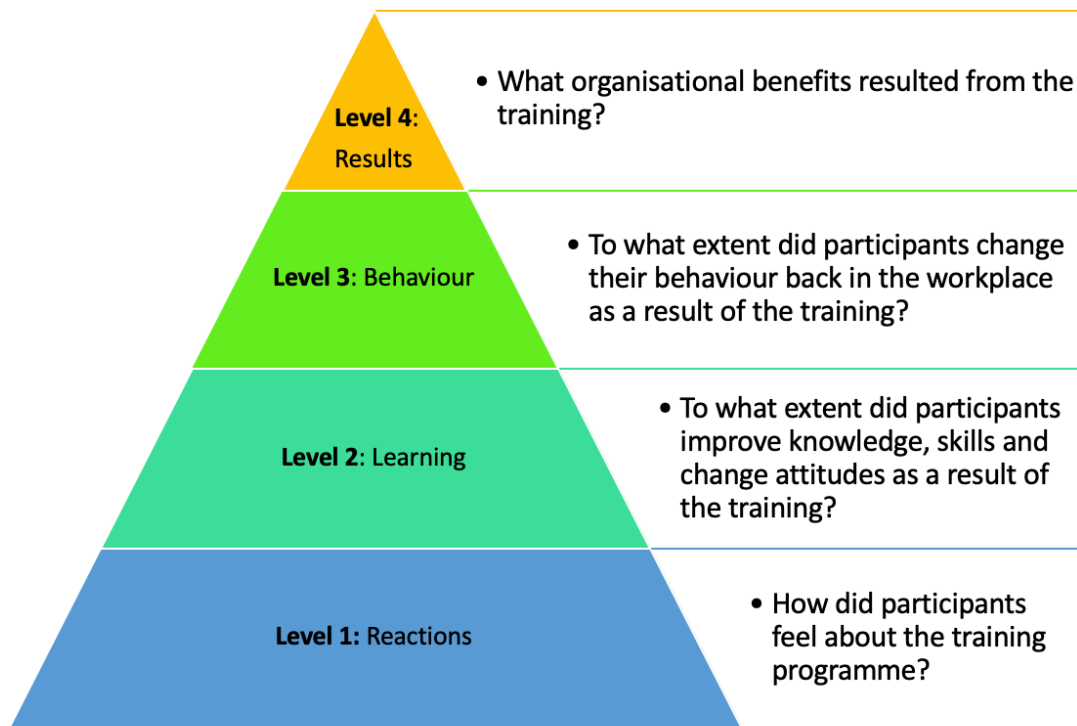


Figure 2: Kirkpatrick's Four-Level Training Evaluation Model. Reproduced from (38).

## Embase Search Strategy:

- 1 exp palliative therapy/ or exp terminal care/ or hospice care/ (151154)
- 2 terminally ill patient/ (7625)
- 3 "death and dying"/ (6)
- 4 (palliative care or palliative treatment or palliative therapy or palliation).mp. (120904)
- 5 (terminal care or "end of life care" or hospice\$).mp. (56659)
- 6 terminally ill patient\$.mp. (9332)
- 7 (patient\$ adj3 (dying or "close to death" or "end of life")).mp. (12509)
- 8 or/1-7 (182172)
- 9 Students, Medical/ (51483)
- 10 medical student\$.mp. (75027)
- 11 medical school/ (55099)
- 12 medical school\$.mp. (73246)
- 13 or/9-12 (127057)
- 14 8 and 13 (1803)
- 15 exp Teaching/ (86827)
- 16 (teach\$ or learn\$ or lecture\$ or small group\$ or reflection or reflective or pedagogy or  
workshop\$ or online or virtual or quiz or video).mp. (1256127)
- 17 pedagogic\$.mp. (7761)
- 18 or/15-17 (1258970)
- 19 14 and 18 (878)
- 20 academic achievement/ or professional competence/ or clinical competence/ or self-evaluation/  
(149763)
- 21 (outcome\$ or effective\$ or confidence or confident or knowledge or success\$ or fail\$ or fear or  
thanatophobi\$).mp. (8137194)
- 22 palliative care scale.mp. (18)
- 23 best practice.mp. (20037)
- 24 competen\$.mp. (233848)
- 25 (measure\$ or assess\$).mp. (7689652)
- 26 or/20-25 (12885963)
- 27 19 and 26 (645)



# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4 (table 1)
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	5



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	6
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	6 (table 2)
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	6
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	8
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	9
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).

Page 2 of 2

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# BMJ Open

## How effective is undergraduate palliative care teaching for medical students? A systematic literature review

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Manuscript ID	bmjopen-2019-036458.R1
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Date Submitted by the Author:	13-Apr-2020
Complete List of Authors:	Boland, Jason; Hull York Medical School, Brown, Megan; Hull York Medical School, Health Professions Education Unit; Duenas, Angelique ; Hull York Medical School, Health Professions Education Unit Finn, G; University of York, Hull York Medical School Gibbins, Jane
<b>Primary Subject Heading</b>:	Palliative care
Secondary Subject Heading:	Medical education and training
Keywords:	Adult palliative care < PALLIATIVE CARE, EDUCATION & TRAINING (see Medical Education & Training), GENERAL MEDICINE (see Internal Medicine), MEDICAL EDUCATION & TRAINING

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# How effective is undergraduate palliative care teaching for medical students?

## A systematic literature review

**Running head:** Palliative care teaching for medical students

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## Abstract

Palliative care is central to the role of all clinical doctors. There is variability in the amount and type of teaching about palliative care at undergraduate level. Time allocated for such teaching within the undergraduate medical curricula remains scarce. Given this, the effectiveness of palliative care teaching needs to be known.

**Objectives:** To evaluate the effectiveness of palliative care teaching for undergraduate medical students.

**Design:** A systematic review (PROSPERO registration CRD42018115257) was prepared according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidance. Screening, data extraction, and quality assessment (mixed methods and Cochrane risk of bias tool) were performed in duplicate.

**Data Sources:** Embase; MEDLINE; PsycINFO; Web of Science; ClinicalTrials.gov; Cochrane, and grey literature in August 2019. Studies evaluating palliative care teaching interventions with medical students were included.

**Results:** 1446 titles/abstracts and 122 full text articles were screened. 19 studies were included with 3253 participants. 17 of the varied methods palliative care teaching interventions improved knowledge outcomes. The effect of teaching on clinical practice and patient outcomes was not evaluated in any study.

**Conclusions:** The majority of palliative care teaching interventions reviewed improved knowledge of medical students. The studies did not show one type of teaching method to be better than others, and thus no “best way” to provide teaching about palliative care was identified. High quality, comparative research is needed to further understand effectiveness of palliative care teaching on patient care/clinical practice/outcomes in the short and longer term.

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3 **Funding:** None  
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5 **Registration:** PROSPERO, CRD42018115257  
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10 **Article Summary: Strengths and limitations of the review**  
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- 13 • This was a rigorously conducted systematic review, including “grey” literature, which  
14 evaluated the quality of included studies.  
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  - 16 • Studies using objective measures of assessment were included; with studies only  
17 reporting subjective assessments, self-reports and opinions of participants being  
18 excluded. Studies using external ratings as assessment of students were included.  
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  - 20 • Even using a systematic approach, it remains possible some studies might have been  
21 missed.  
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  - 23 • Publication bias is possible, as studies yielding negative results are less likely to be  
24 published and, although ‘grey’ literature was searched, this may not have fully  
25 captured unpublished works.  
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  - 27 • In view of the variability in interventions and outcomes between included studies, a  
28 meta-analysis was not possible.  
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43 **Keywords:**  
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45 Palliative care; palliative medicine; hospitals, teaching; teaching; systematic review;  
46 education, medical; education, medical, undergraduate.  
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## BACKGROUND

Palliative care is the holistic care of people with advanced, incurable illnesses, and their families.<sup>1</sup> The spectrum of patients receiving palliative care is wide reaching, and ranges from care at the point of incurable illness diagnosis, to the care of dying patients.<sup>1</sup> Palliative care is interdisciplinary in nature and involves: symptom control; information sharing with patients; advance care planning; coordination of interdisciplinary input; and care for the families of patients.<sup>2</sup> The literature informs us these are the key areas which are deemed important to patients when diagnosed with an advanced and incurable illness.

Medical students and doctors require the appropriate knowledge, skills and attitudes to care for patients who have an advanced and incurable illness. For example, in the United Kingdom, it is estimated in their first year of working, newly qualified Foundation Year 1 (FY1) doctors will care for approximately 40 patients who will die under their care, and a further 120 patients who are in the last months of life.<sup>3</sup> The ability to care for, and communicate appropriately with these patients and their families is an essential skill for all doctors.<sup>4</sup>

Current medical curricula are saturated,<sup>5</sup> and competition for teaching time is fierce. There is an increased drive to incorporate palliative care teaching into medical schools,<sup>6</sup> in the hope to improve care for patients. Greater integration of palliative care teaching represents the acknowledgment that care of these patients and those who are dying has room for improvement. Furthermore, an aging, multimorbid population and a growth in the diversity of palliative treatment options also contribute to the surge in recognition of palliative care's importance.<sup>7, 8</sup> Given this increased drive to incorporate palliative care teaching, we need to ensure there is an evidence-base around its effectiveness as justification for its inclusion and/or how to best use this time. Despite this, no contemporary examination of palliative care-related teaching methods exists. The efficacy of various methods has not been recently evaluated, and it is therefore difficult to conclude which methods infer the most benefit upon medical students.

## AIM

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2  
3 The overall aim of this review was to evaluate the effectiveness of palliative care teaching  
4 upon medical students.  
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## 10 **METHODS**

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12 This systematic review was designed using the Preferred Reporting Items for Systematic  
13 Reviews and Meta-Analyses (PRISMA) Protocol 2015 guidance,<sup>9</sup> and registered with  
14 International Prospective Register of Systematic Reviews (PROSPERO, CRD42018115257). It  
15 is reported according to PRISMA guidelines.<sup>10</sup>  
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### 23 ***Search strategy***

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25 A search and associated terms were developed with an information science specialist to  
26 determine the best search strategy. Studies of palliative care teaching were searched using  
27 the terms “palliative care,” “medical student,” “Education, Medical, Undergraduate” and  
28 “teaching”. To increase sensitivity, Medical Subject Headings (MeSH) terms and free text  
29 terms were used in searches using the electronic databases Embase (Ovid); Ovid  
30 MEDLINE(R) In-Process & Other Non-Indexed Citations; PsycINFO (Ovid); Conference  
31 Proceedings Citation Index–Science (Web Of Science; Thomson Reuters, New York City, NY);  
32 ClinicalTrials.gov (US NIH); ISRCTN registry (BMC); Cochrane Database of Systematic Reviews  
33 (Wiley); Cochrane Central Register of Controlled Trials (Wiley); and Health Management  
34 Information Consortium (HMIC) (Ovid). Searches were also conducted for grey literature  
35 using the following online databases: the Bielefeld Academic Search Engine (BASE)  
36 (<https://www.base-search.net/>), OpenGrey (<http://www.opengrey.eu/>), and Mednar  
37 (<https://mednar.com/>). The Embase search strategy is included as a supplementary file.  
38 Search strategies from all other databases are available on request from the authors.  
39 Searches were carried out on 06/08/2019.  
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53 Reference lists of relevant articles (included studies and reviews) were hand searched.<sup>11</sup>  
54 Authors’ personal files were also searched to make sure that all relevant material has been  
55 captured. Finally, we circulated a bibliography of the included articles to the systematic  
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review team, as well as to scholarship palliative care clinicians' experts identified by the team, to ensure any relevant literature was not missed.

### **Eligibility criteria**

Studies evaluating a palliative care teaching intervention directed towards medical students were included (Table 1). Where there were mixed study populations and data, studies were only included if data on medical students could be individually extrapolated. To be included, studies needed to demonstrate an objective measure of knowledge or skills (e.g. a test score); studies with only self-opinion/self-perspective, reflective essays and qualitative outcomes were excluded.

Titles/abstracts and full-text papers were independently screened against pre-defined eligibility criteria (table 1) by two reviewers (J.B. and either A.D./M.B.). Disagreement at all stages was resolved by consensus and/or with a third reviewer (either J.B., A.D./M.B.). The results of the searches were shown in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1).

**Table 1: Eligibility criteria for inclusion or exclusion based on key study criteria.**

<b>Study Design:</b>	
Inclusion:	Exclusion:
Randomized studies, non-randomised studies, cluster studies, before and after studies, cohort studies, observational studies, case-control studies and narrative research studies.	Case studies. Opinion pieces (commentaries, letters, editorials).
<b>Participants:</b>	
Studies in medical students. There were no exclusions based on age or course type.	
<b>Interventions:</b>	
Studies of any type education were considered for inclusion. This included but was not limited to Online (lectures, videos, quiz), workshops, lectures, small group teaching, bedside teaching, reflection, reflective essays.	

<b>Comparators:</b>	
Any comparators were considered for inclusion. Likely to be no, different, or less education.	
<b>Outcomes:</b>	
Any outcome measure assessing the effectiveness of palliative care learning and teaching. These might relate to competence/skills, and/or knowledge, and include but not limited to, exam scores.	Studies with only student's self-opinion/self-perspective, reflective essays and qualitative outcomes were excluded as the primary interest was objective measures of effects of palliative care teaching interventions.
<b>Timing:</b>	
No restrictions on length of follow up after the teaching was delivered to medical students.	
<b>Setting:</b>	
No restrictions by country or education setting (providing it was to medical students).	
<b>Date:</b>	
Be no restrictions by date.	
<b>Language:</b>	
No language restrictions for searching studies. Non-English language papers were included in the review and every attempt was made to translate all included foreign language papers. However, if translation was not possible, this was recorded.	
<b>Publication status:</b>	
Published as well as unpublished work was searched for and considered for inclusion. If only an abstract was available, the authors were contacted to attain further information from their study.	

### **Data extraction**

Data were extracted in duplicate (J.B. and either A.D./M.B.) for the aim, study setting, design, population included, educational intervention and comparator, assessment method used, outcomes, Kirkpatrick Model level,<sup>12</sup> study quality, strengths/limitations and ideas for further research (determined by the study authors and reviewers) onto pre-prepared templates.

### **Quality assessment**

The methodological quality of each study was independently assessed by at least two reviewers (JB and either AD/MB). Disagreement was resolved by consensus and/or with a third reviewer (either A.D. or M.B.). The mixed methods tool (MMAT) was used if the study was mixed methods<sup>13</sup> and Cochrane risk of bias tool was used if a study was quantitative.<sup>14</sup>

The MMAT is a critical appraisal tool developed to evaluate studies using both qualitative and quantitative data.<sup>15</sup> MMAT was used in line with its original purpose, to appraise mixed methods research and to evaluate non-randomised quantitative research. Two screening questions are asked, before progression to more detailed analysis:

1. Are there clear research questions?
2. Do the collected data allow to address the research questions?

In this review, the answer to both of these questions had to be 'yes' for a study to qualify for inclusion. Evaluation using MMAT subsequently focused most heavily on appraising methodology, assessing five core criteria for each study type. These core criteria can be reviewed in detail, with additional usage guidance, using the 2018 iteration of the MMAT tool.<sup>15</sup> To aid interpretation of what was meant by the core quality criteria, the research team referred to this expanded guidance. A summary of the core criteria for mixed methods research and nonrandomised quantitative research, the ways in which the MMAT was used in this work, are listed in table 2.

Study design	Core quality criteria
Mixed-methods research	<ol style="list-style-type: none"> <li>1. Is there an adequate rationale for using a mixed methods design to address the research question?</li> <li>2. Are the different components of the study effectively integrated to answer the research question?</li> <li>3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?</li> <li>4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?</li> <li>5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?</li> </ol>

Non-randomised quantitative research	<ol style="list-style-type: none"> <li>1. Are the participants representative of the target population?</li> <li>2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?</li> <li>3. Are there complete outcome data?</li> <li>4. Are the confounders accounted for in the design and analysis?</li> <li>5. During the study period, is the intervention administered (or exposure occurred) as intended?</li> </ol>
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Table 2: Summary of MMAT core quality criteria for mixed-methods and non-randomised quantitative research, adapted from Hong et al.<sup>15</sup> NB: when criteria 5 of mixed-methods research references adhering to the quality criteria of each method involved, it references the quality criteria listed in other sections of the MMAT of the individual methods used, e.g. the quality criteria for non-randomised quantitative research. This research followed this guidance.

The Cochrane risk of bias tool was used to appraise any randomised trial studies; as it is the gold-standard for such evaluation.<sup>14</sup> The Cochrane risk of bias tool has more stringent appraisal criteria, focusing on evaluating the presence of several types of bias: selection bias; performance bias; detection bias; attrition bias; reporting bias; and other bias. The plausible bias within studies deemed 'low risk' were unlikely to seriously alter results and therefore be accepted. Studies at medium risk of bias imply 'some confidence that the results represent true effect'. Despite medium risk, the issues with these studies are 'not sufficient to invalidate results'; these studies were therefore included in our review unproblematically.<sup>16</sup> Studies rated as high risk of bias should be considered sceptically.

### ***Data analysis and synthesis***

Due to the heterogeneity of results, a narrative data synthesis was performed. A team of researchers were involved in the synthesis and development of themes, and analysis of potential biases and quality. Four stages took part with all members of the research team:



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3 (1) development of a theoretical model, (2) preliminary synthesis, (3) exploration of  
4 relationships in the data (4) and assessing the robustness of the final synthesis.<sup>17</sup>  
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### 10 **Patient and Public Involvement**

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12 No patient involved in this systematic review.  
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## 16 **RESULTS**

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19 The search identified 1446 titles and abstracts for initial screening against the study's  
20 eligibility criteria. Following this, 122 full text articles were screened in detail for eligibility.  
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22 19 studies were included. The total number of participants in the 19 studies was 3595, data  
23 were gained and used from 3253 participants, with long-term follow-up data (up to 1 year)  
24 in 274 participants (from 3 studies). Publication dates were between 2002 and 2018. The  
25 number of participants in the included studies ranged from 40 to 670; with a mean of 171.2  
26 participants per study (table 3).  
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### 35 **Quality appraisal**

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37 The quality of mixed methods studies were assessed using the Mixed Methods Appraisal  
38 Tool (MMAT) (n=11),<sup>13</sup> and purely quantitative studies using a trial type of methodology  
39 were assessed using Cochrane risk of bias tool (n=8).<sup>14</sup>  
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43 Overall the 11 mixed method studies included met all required components of quality using  
44 the MMAT (table 3).  
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47 The Cochrane risk of bias tool was used to appraise any randomised trial studies. Included  
48 studies showed a range of bias; 1 was high risk of bias, 5 were medium risk of bias and 2  
49 were low risk of bias (table 3).  
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Table 3: Data extraction table

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Auret 2008 Australia	Identify if a structured clinical instruction module improves students self-rated confidence	Pre & post-test design.	91 6 <sup>th</sup> year medical students  (91/106 students: response rate=86%)  Follow-up questionnaire at end of academic year: 30/109 students (response rate=28%)	2 hour Structured Clinical Instruction Module - nine 15minute stations. 4 groups of 30-35 students (in groups of 4).  Taught by 1 palliative care consultant + team of nurses/doctors / pharmacist	Acted as own comparator, pre- & post test	Questionnaire – 6-point Likert scale. Pre workshop, immediately post workshop + follow-up at end of academic year	Improved knowledge and skill post workshop. Poor rate of completion of follow-up, but sustained improvement.	2a	Assessed using Cochrane risk of bias tool, medium risk of bias. Risk of attrition bias- 86% initial completion rate dropped to 28% completion at end of academic year. Reasons not fully explored.	Strengths- required less facilitators than some other interventions, 'practical feel'. Limitations- no statistical reporting, poor response to longer-term follow-up minimising evaluation of knowledge retention.	To formally test knowledge and skill competence following workshop
Brand 2012 Australia	Evaluate students' knowledge, attitudes and experience of a palliative care education programme in a graduate entry medical setting	Pre & post-test design knowledge and Self-Efficacy in Palliative Care	62 2 <sup>nd</sup> year graduate med students. 40/62 (64.5%) completed both the pre- and the post-test  Taught by 4 palliative care consultants + 4 registrars	8 hours palliative teaching within 100-hour oncology curriculum. 5 week oncology/ palliative care block. Lectures, PBL sessions, bedside/clinic tutorials, visit to inpatient unit, self-directed reading.	Acted as own comparator, pre-test & post test	Multiple choice question knowledge test, 2 validated attitudinal scales, student feedback survey (Likert scale + open ended questions)	No statistical significance in mean improvement in knowledge. Subset statistical improvement in symptom management (p=0.001). improvements in attitudes towards communication, symptom management and MDT care	2b	Assessed using mixed methods tool- passed all components.	Strengths: Mixed methods study. Limitations: Possible selection bias – only 64.5% completed pre and post tests and 42% response rate to student evaluation questionnaire, multiple choice questions weren't independently validated.	No

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Brownfield 2009 USA	Examine the feasibility of a 1-week palliative care course incorporated into the medicine clerkship; knowledge and attitudinal changes in students who had completed the course.	Pre & post-test design	84 Third year medical students.  53/84 (63%) students completed both pre- and post-tests	1-week palliative care curriculum during a 1-year period. Included in-patient and out-patient care, MDT rounds, reflection and didactic teaching around core clinical topics.	Acted as own comparator, pre-test & post test	Survey of attitudes towards palliative care and pre- and post-course measurements of knowledge.	Statistically significant improvement in knowledge scores (pre-course mean scores 145/230 and 175/230 post-intervention (P<0.01). Improved attitudes.	2b	Assessed using mixed methods tool- passed all components.	Strengths- mixed methods study.  Limitations- 63% response rate even to knowledge tests- response bias.	No
Chang 2009 China (inc Taiwan).	Evaluate the effect of a multimodal teaching program on preclinical medical students' knowledge of palliative care and their beliefs relating to ethical decision-making.	Pre & post-test design	118 third year medical students- 'pre-clinical' in Taiwan as medicine is a 6-year degree. Voluntary participation.  Taught by palliative care doctors, clinical social workers, chaplain, nurse practitioner/nurse lead for palliative care.	1 week, end of life care curriculum developed. 3 learning modules. Included bedside teaching, lecture series and small group discussion.	Acted as own comparator, pre-test & post test	Assessed knowledge + beliefs regarding decision making. Instrument constructed based on literature review and national guidance. Validated for use by content expert and tested for reliability- items not meeting reliability statistical cut off excluded.	Improved knowledge following intervention by 14.7% (p<0.001). Clinical management knowledge improved the most. Some improvement in beliefs regarding decision making but not universal.	2b	Assessed using Cochrane risk of bias tool- Medium risk of bias. Selection bias likely to be present- students were volunteers, risking self-selection bias. 100% response rate- no attrition bias.	Strengths- validated test tool.  Limitations- only 18/32 knowledge items reliable enough for inclusion. Knowledge questions were true/false/not sure. Follow up immediately after intervention, not testing long-term retention of knowledge.	None discussed
Day 2015 USA	Compare the effect of eLearning	Quasi-randomized controlled	119 Third year medical students.	Interactive e-learning: eDoctoring on	26 Small group sessions on	Pre-test and post-test	Both groups- knowledge questions	2b	Assessed using Cochrane risk	Strengths- quasi-randomised	No

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	versus small-group learning	trial of web-based interactive education (eDoctoring) compared to small-group education (Doctoring)	eDoctoring (n = 48) or small-group Doctoring (n = 71).	palliative care clinical content over two months.  No faculty input whilst taking the course.  Small group teaching for 3 hrs on communication skills. Year-long course.	palliative/end of life care.  Small group teaching for 3 hrs on communication skills. Year-long course (same as intervention arm).	questionnaires. 27 self-efficacy questions-rating confidence. 6 single best answer knowledge questions relating to curriculum covered by modules completed in eDoctoring.	improved post-test, non-statistical trend present favouring the eDoctoring students. in self-efficacy ratings in both intervention and control, with no differences in improved between the groups.		of bias tool. Medium risk of bias. Quasi-randomised, low selection bias. Attrition bias possible-more dropouts in Doctoring arm (results excluded from analysis) - reasons not explored.	Limitations-. No long-term measures in knowledge retention. Randomisation did not include technology fluency or viewpoints.	
Dorner 2014 Germany	Explore the feasibility of peer teaching for communication skills training.	Pre & post-test study	37/49 (76%) medical students in in the fourth to sixth of medical school. Voluntary participation open to all medical students  Tutors- Fifth & sixth year medical students trained by faculty to deliver teaching.	90-minute peer taught workshop teaching 9 core communication skills regarding palliative and end of life care, particularly within the intensive care unit. Case based discussions and role play both used.	Own comparator, pre-test & post test	External 'intensivist' rated students based on a taped role play they conducted with another student. Qualitative analysis of transcripts to see how students spoke about death. Self-rated skills scores.	Self-rating scores improved following intervention (P<0.001). Mean expert ratings did not differ from student's own assessment of performance or skills except in one domain	2b	Assessed using mixed methods tool-passed all points.	Strengths- peer teaching affordable and easily scalable. Limitations- lacks long term evaluation	Further work required regarding student's ability to use the word 'death'.
Ellman 2016 USA	Evaluate four-year curriculum in palliative care.	Mixed-method evaluation	First to fourth year medical students. 95 students in the implementation year	4-year longitudinal, integrated curriculum. Included workshops,	Comparator only for graduating student surveys-compared	Competency in a palliative care OSCE station at the end of the curriculum.	In implementation year, average score 74% in OSCE palliative care station-	2b	Assessed using mixed methods tool-passed all points.	Strengths: mixed methods study, curriculum is well integrated	In order to evaluate longer term effect of curriculum, team are planning a

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
				hospice experience, modules, communication skills and a year 4 palliative care observed structured clinical examination (OSCE) station. 2 hours in 1 <sup>st</sup> year; 4 hours in 2 <sup>nd</sup> year; 15-23 hours in 3 <sup>rd</sup> year; 4 hours in 4 <sup>th</sup> year.	with national Association of American Medical Colleges questionnaire of US medical schools regarding confidence with palliative care.	Analysis of student written reflections. Graduating student surveys- regarding how prepared students felt following course.	lower than average score for other OSCE stations (84%) but felt to be 'acceptable'. Students undertaking 4-year curriculum felt more prepared in palliative care compared with other US medical schools.			and longitudinal. Limitations- no long term follow up data, OSCE station on palliative care scored lower still than OSCE stations on other subjects	survey of former students now in postgraduate training.
Gerlach 2015 Germany	Evaluate the effects of the Mainz undergraduate palliative care education (UPCE) on students' self-confidence regarding important domains in palliative care.	Prospective questionnaire-based cohort study with a pre-post design. Knowledge test only at end of module	329 Fifth year medical students. All students took knowledge test.  156 (47%) students completed matched surveys at both points of measurement  Facilitators: physicians, palliative care nurses, bereaved family members.	Mandatory palliative care module over one term. 7x90 minute sessions. Included pain lecture hospice home care through use of videoed live interview with bereaved family member. Small group discussion.	Knowledge scores: historic test scores from before the intervention within Mainz examined- same test so comparison is likely acceptable. Self-confidence scores, comparison with cohort from 2011 in Mainz who did not receive module.	Multiple choice electronic knowledge exam after module- 21 item, single best choice answer. Pre and post testing of students' self-confidence.	All passed knowledge exam, average scores >90%. Compared to historic cohort: increased in correct answers for pain (40%), symptom control (69%), and psychosocial knowledge (33%). Self-reported confidence improved.	2b	Assessed using Cochrane risk of bias tool. Medium risk of bias. Attrition bias: 47% of surveys matched for pre-and post-test results, so data lost. Reasons are clear- incomplete form completion, effect of this is unclear.	Strengths- Intervention acceptable, enjoyed interdisciplinary input. Limitations: only 47% of surveys pre and post intervention matched and used (due to local policy), unknown if increases in knowledge and self-confidence are linked.	Whether or not the course provided only an instant or a long-term effect- research underway. Further research needed regarding any effect on patient outcomes.
Goldberg 2011 USA	To assess the effect of a required	Historical control trial.	117 Fourth year medical students	N=59 (51% of students from class of 2008)	N=58 (55% of students from class of 2007)	Survey: self-rated skills performance	No statistical difference in mean scores	2b	Assessed using mixed methods tool-	Strengths: mixed-methods	Further research into qualitative

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	clinical rotation in palliative medicine		(month prior to graduation)  Taught by 2 interdisciplinary teams, each with an: attending physician, fellow in palliative med/geriatrics /oncology, a nurse practitioner, & a social worker staff (clinical team portion) + social worker, chaplain, & massage therapist	Addition of a required 1-week clinical rotation in palliative medicine (integrated in 12-week IM-Geriatrics clerkship) – multiple venues, time spent with consult team + formal didactic lectures on palliative care issues	= historical control group (received didactics but no clinical rotation in palliative medicine)	& interest, student educational experience, 30-question MCQ exam  2008 cohort also had 2 open-ended questions  Components of Association of American Medical Colleges annual graduate questionnaire	for knowledge questions  Higher skills self-ratings in 2008 cohort  Association of American Medical Colleges questionnaire: 2008 cohort more experience in palliative care		passed all points.	study, utilised historical control group  Limitations: Diversity of exposure with clinical rotations, not controllable	findings – how might reported skills be applied  Exploring different venues of palliative care (outpatient) for clinical rotations
Green 2010 USA	Pilot study evaluating the effectiveness of a computer-based decision aid for teaching medical students about advance care planning.	Prospective, randomized controlled design	133 Second year medical students.  121/133 (91%) of students agreed to have their data used in study - 60 in the Decision Aid Group and 61 in the Standard Group.	Computer based decision aid for student use to help patients with advanced care planning (to help patient complete advance directive). Multimedia tool, uses educational material and exercises to help patient clarify values and priorities, help students explain end of life conditions and	Prior to intervention all students received instruction in advanced care planning-lectures, reading material, small group discussion.	Knowledge assessed using a 17-item true/false and MCQ. Self-rated satisfaction, confidence and perceived knowledge of patient wishes. Patients' evaluation of student assessed using 12-items addressing students' communication skills, helpfulness, and perceived	High baseline knowledge for advance care planning. Students in decision aid group more improved (84% to 88%, p<0.01) Student confidence increased following interventions in both groups but more in decision aid group. Student satisfaction higher in	3	Assessed using Cochrane risk of bias tool. High risk of bias. No discussion of how students were randomised so unclear if selection bias is present. patient bias-students were responsible for recruiting patients and these were eligible to be family/friends	Strengths- tool easy to roll out and applicable within other institutions. High levels of student and patient satisfaction. Limitations- pilot study so not powered. Selection of patients determined by students. No full data regarding student interactions with patients, time spent. Confounding	National study comparing this computer programme with current approaches to advance care planning.

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
				treatments and then helps synthesise this into an advance directive.		understanding of their wishes. Patients' satisfaction assessed by measure of global satisfaction	decision aid group. Patients significantly more satisfied with student performance and global impression in decision aid group.		- patient rating scales may well be biased.	factors within this that could have impacted results. Measures used within the study not validated.	
Jackson 2002 USA	Evaluate a palliative medicine curriculum developed for medical students in the required third-year clerkship in family medicine at the University of Tennessee.	Pre & post-test design with the post-test assessment seven weeks later.	69 Third year medical students on their family medicine clerkship	Four-hour curriculum. Prior to session students were sent reading concerning palliative care. During session-discussion, role play, information giving via PowerPoint and lecture.	Acted as own comparator, pre-test & post test	20 item pre-test and post-test for palliative care knowledge. One item confidence question regarding palliative care clinical skills.	Significant knowledge gain post-test (37% pre-test to 55% post-test); (p<0.0001). Small but statistically significant increase in self-reported confidence (p=0.031).	2b	Assessed using Cochrane risk of bias tool. No bias noted in any domains. Low risk of bias.	Strengths- Popular with students on course evaluation-. Limitations- other palliative care education at institution.	long-term retention of knowledge and the development of instruments to measure the translation of a theoretical knowledge base into actual clinical skill sets.
Paneduro 2014 Canada	Develop and evaluate a pain management & palliative care seminar for medical students during surgical clerkship	Pre & post-test design with the post-test assessment at 1 year	292 Third & Fourth year medical students in surgical clerkship  95% (n=277) completed post-test immediately following the seminar and 31% (n=90) completed the	4-hour seminar on pain management and palliative care  Taught by faculty from pain medicine, surgery & palliative care	Acted as own comparator, pre-test & post test	10-item knowledge test  Comments on seminar	Significant knowledge improved; maintained at 1 year. mean pre-test, post-test and one-year follow-up test scores were 51%, 75% and 73%, respectively.  No difference between 3 <sup>rd</sup> &	2b	Assessed using mixed methods tool-passed all points.	Strength: Relatively short items to respond to in order to facilitate participant, collaboratively designed seminar  Limitations: high attrition rate at 1 year. Hard to	Modify seminar to better target attitudes/beliefs

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
			follow-up test via e-mail.				4 <sup>th</sup> year students			control for seminar impact specifically, at long-term follow-up	
Poter- Williamson 2004 USA	Assess impact of a hospice curriculum for medical students, in terms of knowledge, skills, & attitudes	Pre & post- test study	127 Third year medical students	32-hour, 4-day curriculum	Acted as own comparator, pre-test & post test	26-item self- assessment of competency, a 20-item self- report of concerns, a 50-item MCQ knowledge test, & qualitative assessment of course curriculum	23% improved knowledge 56% improved competence 29% improved for concerns (all p<0.0001). No changes for attitudes (p=0.35) (already had appropriate attitudes)	2b	Assessed using mixed methods tool- passed all points.	Strength: multiple measures of curricular evaluation, curriculum could be applied at other universities  Limitations: no long-term follow-up	link specific clinical encounters with clinical knowledge changes, for explanation; longitudinal re- examining
Shultz- Quach 2018 Germany	Evaluate an eLearning course “Palliative Care Basics” in terms of student acceptance, exam performance, and competence	Cross- sectional study	670 Undergraduate medical students (3 cohorts). 569 (96%) used eLearning as preparation for the exam; 23 did not.	eLearning course (5 teachings domains over 10 teaching units). Virtual patient contact, didactic teaching, e- lectures, patient case vignettes	Students who did not access the eLearning course. 23 students	Questionnaire of self- assessment  Course eval, with ratings and free response section  20-item MCQ exam	Knowledge improved (p=0.02). High approval of eLearning tool – easy to approach topics, increased interest,	2b	Assessed using mixed methods tool- passed all points.	Strength: Mixed- methods  Limitations: no baseline measurements , very small comparator group	Further assessment of eLearning tools in blended curriculum
Tai 2014 Australia	Assess whether a 1- week palliative care placement improves student performance	Consecutive cohort Retrospective analysis, pre & post- test mixed methodology	84 Fifth year medical students (who enrolled in palliative care placement).  72 (86%)	1-week palliative care placement  Combination of didactic and interactive tutorials with	Acted as own comparator, pre-test & post test/course	Knowledge based questions (16 MCQs)  Post-course satisfaction ratings (10-	Improved knowledge: average 58% to 74% (P<0.001).  Most reported value of course	2b	Assessed using mixed methods tool- passed all points.	Strength: mixed- methods.  Limitations: measures not validated; reduced	Assess value of different length palliative care placements (1 week might not be enough)



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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	& knowledge. Explore student views on palliative care rotation, particular for building confidence		completing both pre- and post-course multiple-choice questions	experiential attachment such as ward rounds		closed item questions + 2 open-ended questions)	and wanted more palliative care education			sample size due to exclusion of students who did not complete both parts of study	
Tan 2013 Canada	Determine whether virtual patient case in palliative care could offer students acceptable alternative to real-life experiences	Mixed methods pre & post-survey	137 Third year medical students  95% (130/137) consented to have their results analyzed. knowledge score assessed in 127	Virtual patient clinical case, mandatory exercise in family medicine rotation  Average time spent with virtual patient case = 0.93 hours, SD=0.65	Acted as own comparator, pre-test & post test	Knowledge test & level-of-preparedness survey (self-assessment of clinical skills), plus student feedback on virtual patient case/usage & general feedback	Knowledge scores increased (48-63%; p<0.001)  virtual patient case was realistic (91%), and educational (86%)  Students spending >20 minutes on case reported more engagement	2b	Assessed using mixed methods tool-passed all points.	Strength: mixed-methods approach for evaluation  Limitations: hard to correlate time spent on case with outcomes, limited info about students' experiences with real patients	Expanding knowledge component of study to better understand specific changes in knowledge
Tsai 2008 China	Assess the impact of a 4-hour multicomponent curriculum on knowledge & attitudes of end of life care	Prospective cross-sectional pre & post- test survey	259 Fifth year medical students	4-hour course included: 1 hour lecture by specialist, 1 hour patient visit at unit, 1 hour literature reading, 1 hour discussion	Acted as own comparator, pre-test & post test	Questions on knowledge, demographics & ethical beliefs	Knowledge improved (55% to 70%) (p<0.0001). Principles of palliative care scores improved (58% to 73%). Clinical management improved (59% to 68%)	2b	Cochrane risk of bias tool-Low risk of bias, no bias evident in any domains.	Strength: easy to implement curriculum. correlation analysis across items  Limitations: hard to control for confounding variables like maturation effect	Further assessment of medical training (residency & clinical practice) – follow up studies  Longitudinal study to better understand changes over time

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Tse 2017 USA	Explore the application of online learning tool with hospice experience	Randomised prospective pre & post study	152 Second year medical students completed the survey (response rate 51%)  56% (n=85) completed the online module	Addition of 30 min online module to hospice experience. Taught by hospice care physician or nurse ) in hospice setting	Randomised to receive module prior to hospice experience (YES module) versus after experience (NO module)	23-item electronic survey: 10 attitude-assessing statements from FATCOD, 8 multiple choice knowledge questions	Higher scores on knowledge questions for students completing the online module (p=0.006).  No statistical difference in attitudes	2b	Assessed using Cochrane risk of bias tool, medium risk of bias. self-selection bias as voluntary participation, could suggest already motivated regarding palliative care. Randomisation not described	Strengths-mixed methods study, focused on assessing blended learning experiences  Limitations: Single site study, survey was relatively few items	Expanding scope of study for more institutions (generalisability)  More survey items → more comprehensive assessment
Von Guten 2012 USA	Assess impact, retention, & magnitude of effect of a required didactic & experiential palliative care curriculum	Prospective pre-post study	487 Third year medical students	Specified palliative care curriculum designed for 1 day/week for 4 weeks (during the ambulatory block of the 12-week IM clerkship)  Taught by IM faculty. participation was compulsory	Self-comparator over time (pre-test & post-test).  knowledge compared with national cross-sectional study comparing residents at progressive training levels	36-item knowledge test, self-assessment of competency, & self-assessment of attitudes + written surveys	Knowledge: improved 52% to 67% (national residents, average score 62%). 56% improved confidence (higher than resident national averages). 29% decrease in concern. (All p<0.001).  All maintained at 1 year.	2b	Assessed using mixed methods tool-passed all points.	Strength: mixed methods, assess various levels of effect, national comparison  Limitations: evaluation instruments designed for specific learning objectives of course. Documentation of long-term follow-up unclear	None outlined by study

## ***Context of Included Studies***

### *Demographics*

The selected studies took part in many countries; 9 United States of America (USA), 3 Australia, 3 Germany, 2 Canada and 2 China (including Taiwan).

### *Study designs*

14 of the included studies tested knowledge before and after a teaching intervention, in a pre-post design. The post-test was immediately post intervention in all but 4 studies, with one study conducting its post-test at seven weeks, and the other three at approximately 1-year post intervention. Most of these pre-post designed studies were cohort-type studies; one was randomised, and 3 included a mixed methods design. The other 5 included studies used a randomised controlled design, quasi-randomized controlled trial, historical control trial and 2 cross-sectional design studies (table 3).

### *Types of teaching interventions*

The included studies had a wide variety of teaching methods and teaching hours. The main shared descriptor of palliative care teaching interventions in the included studies was the duration. Studies could be largely summarized as 'small' scale teaching interventions (interventions with a duration of hours), or as 'large' scale teaching interventions (interventions that took place over the course of days). Included studies were categorized into these durations, and durations were decided comparatively by the researchers. In addition to these small and large interventions, a third descriptive category was determined: eLearning interventions. Because the nature of eLearning is often associated with uncertain measures of time (depending on student use outside of learning environment), eLearning interventions were considered to be different than small or large face-to-face teaching interventions. Given the variance in shared descriptors, the decision was made to synthesise results based on the type of intervention: small, large, or eLearning.

### *Different assessment methods*

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3 The studies used different assessment methods and some studies used multiple methods of  
4 assessment (table 3); this made it difficult to assimilate study outcomes. Most commonly,  
5 multiple choice questions (MCQs) were used to test knowledge<sup>18-24</sup> or a combination of  
6 MCQs and true/false questions.<sup>25</sup> The number of items testing knowledge differed between  
7 studies. These ranged from 6 single best answer items,<sup>26</sup> 8 MCQs<sup>27</sup> to 50 MCQs.<sup>23</sup> Other  
8 methods of assessments included an 'external intensivist' rating student performance based  
9 on a taped role play<sup>28</sup> and observed structured clinical examination (OSCE) station  
10 assessment.<sup>29</sup> Some studies also assessed student attitudes and confidence in a pre-post  
11 format.<sup>19, 21, 24, 25, 27, 30, 31</sup>

## 22 **Synthesis of results**

### 23 *Smaller teaching interventions*

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25 Seven of the included studies evaluated a 'small' palliative care teaching intervention; these  
26 included a range of interventions of different sizes, from 1.5 to 10.5 hours, with a median of  
27 4 hours.<sup>19, 20, 28, 32-35</sup> Six of the seven included studies showed statistically significant  
28 improvements in knowledge assessment outcomes (table 3),<sup>20, 28, 32-35</sup> and one of these  
29 studies included a one-year follow-up, with knowledge retention demonstrated.<sup>33</sup> Although  
30 one study did not show overall improvement in knowledge scores, it did demonstrate  
31 statistically significant improvements in symptom management scores in a subset analysis.<sup>19</sup>

### 32 *Larger teaching interventions*

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34 Seven of the included studies evaluated a 'large' palliative care teaching intervention, with  
35 interventions ranging from 4 to 5 days, with a median of 5 days (table 3). Six of the seven  
36 large scale studies demonstrated statistically significant improvements in knowledge  
37 assessment outcomes; although one of these had a poor comparator.<sup>29</sup> One study failed to  
38 demonstrate an improvement in knowledge from mandatory participation in a clinical  
39 palliative care module compared to didactic teaching alone.<sup>18</sup> There were critical limitations  
40 in the comparator used in the study by Ellman et al.<sup>29</sup> Ellman et al developed a new  
41 palliative care OSCE to assess student knowledge regarding symptom management,  
42 communication, and the psychosocial, spiritual, and cultural aspects of care. Competency in  
43 this OSCE station was deemed adequate by the authors (average score 74%) although the  
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3 level attained at this station was below that of other OSCE stations; which was on average  
4 84%.<sup>29</sup> There was also no pre and post intervention testing, thus it is unclear if this  
5 intervention improved knowledge or not.  
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### 8 *eLearning teaching interventions*

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10 Five studies evaluated the effect of eLearning on knowledge in palliative care, with all these  
11 studies demonstrating statistically significant improvements in knowledge scores (table 3).  
12 The specific type of eLearning varied, but included: a virtual patient clinical case,<sup>36</sup> a  
13 computer-based decision aid for advance care planning content,<sup>25</sup> a flipped classroom  
14 online module coupled with a hospice care experience,<sup>27</sup> and an eLearning course.<sup>22</sup> The  
15 fifth study, an Interactive e-learning course, is notable because it reported equivalence in  
16 increasing knowledge scores, when compared with small-group teaching sessions.<sup>26</sup> Of the  
17 eLearning studies included, this is the only one to provide a comparator to the eLearning  
18 resource. However, the study still considered the eLearning intervention to be 'successful,'  
19 as it was determined to be less faculty intensive to run but imparted the same degree of  
20 knowledge as 'traditional' teaching.<sup>26</sup> Overall, all eLearning interventions offered flexibility  
21 for students.  
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### 33 *Summary*

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35 Overall, the majority (n=17) of the included studies demonstrated an improvement in  
36 knowledge. Small amounts of specific teaching improved knowledge in six out of seven  
37 studies. Similarly, large amounts of teaching improved knowledge in six out of seven studies.  
38 All eLearning interventions improved assessment outcomes in tests of knowledge. No  
39 included study directly compared small and large teaching interventions and, as study  
40 outcomes were heterogenous, it was not possible to evaluate whether small or large  
41 interventions were 'better.'  
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## 52 **DISCUSSION**

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54 This systematic review presents a contemporary overview of the literature regarding the  
55 effectiveness of palliative care teaching to medical students. All types of teaching  
56 intervention (small- and large-scale teaching, clinical and eLearning) improved knowledge  
57 scores for medical students. No method appeared to be superior in improving knowledge.  
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3 Few studies explored knowledge retention, skills or attitudes. No studies explored the  
4 impact of teaching on clinical care for patients. Significant heterogeneity of teaching  
5 approaches continues to exist, and is increasing, as new teaching methods (such as  
6 eLearning) develop and grow in popularity. Further contributing to the heterogeneity was  
7 the inconsistency of overall teaching approaches and methods of assessment in all included  
8 studies. This leads to the hypothesis that, regardless of the style of teaching, improvement  
9 in palliative care knowledge scores is possible following teaching. Study designs, too,  
10 differed significantly, with no consistent approach to long term follow up. In view of the  
11 multifaceted heterogeneity evident in both study design and outcomes, the data gathered  
12 systematically were synthesised narratively.<sup>17</sup>  
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### 24 **Outcomes and constructive alignment considerations**

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26 Examining the intervention efficacy with an educational theory lens was the logical first step  
27 in performing a narrative synthesis of included articles in this particular review. One of the  
28 first theories to consider in any study measuring knowledge via assessment is Biggs' theory  
29 of constructive alignment.<sup>37, 38</sup> Constructive alignment argues that there needs to be  
30 alignment of learning outcomes, teaching methods, and assessment measures, otherwise,  
31 true learning may not occur. For example, if an educator presents learning outcomes to  
32 students related to palliative care, but then teaches a session on dermatology, and gives an  
33 assessment with questions concerning cardiology, you would expect students to not pass  
34 their assessment, and conclude learning did not occur. However, in this admittedly bizarre  
35 example, learning might have occurred; it just may have been related to palliative care, or  
36 most likely dermatology. Yet, because these educational components are not constructively  
37 aligned, it would be impossible to actually comment on learning. This same reasoning can be  
38 applied to the studies included in this review. Many studies determined learning occurred,  
39 as exemplified by improvement in knowledge scores. However, one issue when conducting  
40 this review was the inability to know with any certainty how related teaching and  
41 assessment were to one another. It was not made clear by the analysed studies how  
42 constructively aligned their assessment was to the palliative care teaching delivered. It was  
43 clear that some short interventions were geared to improve a specific aspect of palliative  
44 care (e.g. Advanced care planning),<sup>25</sup> but most larger interventions (where details were  
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3 published and we could discern more exact content of the teaching), covered a range of  
4 topics in the palliative care curriculum. Poor detail regarding the content of assessment, and  
5 limited assessment regimens, makes it seem likely only some of these topics were formally  
6 assessed.  
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11 Failure to explicitly acknowledge constructive alignment within any of the included studies  
12 makes it difficult to accurately assess the efficacy of any (especially the large) teaching  
13 interventions. Reproducibility of the value of the interventions will likely largely depend on  
14 specific variables relating to constructive alignment. Utilisation of constructive alignment in  
15 teaching intervention design and assessment may have been an influencing factor as to  
16 whether an intervention improved knowledge scores. However, without discussion of this in  
17 any of the studies, it is not possible to know whether constructively aligned learning  
18 outcomes, teaching and assessment are important to effective palliative care teaching.  
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### 29 **Impact of Teaching Interventions**

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31 Kirkpatrick's Four-Level Training Evaluation Model is used to evaluate the results of  
32 educational programs, which are divided into 4 levels (figure 2).<sup>12</sup> This model was used to  
33 evaluate the impact of interventions in the included studies.  
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36 Included studies in this review were mostly at level 2 of Kirkpatrick's Four-Level Training  
37 Evaluation Model; what students have learned.<sup>12</sup> The only study to assess Behaviour (Level  
38 3) was by Green et al<sup>25</sup> where patient satisfaction was evaluated in an advance directive  
39 scenario. This introduces the concept that for many of these teaching interventions, their  
40 potential efficacy has really only been assessed from a limited viewpoint. Although changes  
41 in knowledge and attitude are important, they do not guarantee the educational experience  
42 will change behaviour/practice. Measuring the clinical impact of a teaching intervention  
43 requires rigorous long-term follow-up, and such follow up was not performed by any studies  
44 within this review. Thus, no conclusions regarding the impact of these palliative care  
45 teaching interventions upon clinical practice or patient outcomes can be made. This is  
46 particularly important as with growing demands and need for quality palliative care in  
47 practice, it is important to understand if medical school interventions are actually improving  
48 later clinical practice, or long-term decisions of medical students. Studies suggest there are  
49 many misconceptions by lay and healthcare professionals of what palliative care is/hospices  
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3 are, and thus one of the main aims of undergraduate teaching should be to try and dispel  
4 these.<sup>39, 40</sup> This was not explored in any of the studies.  
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### 8 **Heterogeneity might indicate wide possibilities for curricular design**

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10 While the effect of palliative care teaching on clinical practice could not be elucidated from  
11 this review, there was significant information relating to potential knowledge gain and  
12 exposure via palliative care teaching interventions. While there was significant  
13 heterogeneity in how knowledge was measured in these studies, interesting findings were  
14 identified. Both small amounts of specific teaching and larger scale interventions improved  
15 knowledge, which may support the argument that institutions should investigate integrating  
16 some level of teaching palliative care, even if small, as these can prove beneficial to the  
17 knowledge base for students. This is supported by the fact that in these studies, regardless  
18 also of the teaching method, improvement in palliative care knowledge scores was possible  
19 following instruction. Again, this provides more evidence that while there seems to be no  
20 identifiable 'best practice' for teaching palliative care in medical education (as no studies  
21 compared this or asked this question, and knowledge scores used by different studies was  
22 not the same), this means that institutions can adapt from a variety of methods that may  
23 work best for their curriculum.  
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37 eLearning also appeared to improve knowledge scores in studies included in this review.  
38 One study demonstrated the potential value of integrated eLearning with existing clinical  
39 experiences; a small, online module provided to students prior to a hospice experience  
40 demonstrated improved knowledge amongst these students.<sup>27</sup> This study, and the others  
41 relating to eLearning, contribute to the possibility that any type of palliative care teaching  
42 may be very beneficial, even with the need for more focused and detailed research.  
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### 51 **Limitations of included studies**

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53 The main limitation of the included studies is that none assessed effect upon clinical  
54 practice and patient outcomes. Thus, the effect on clinical practice of each teaching  
55 intervention is unknown. Only 3 studies undertook follow-up and collected long-term data;  
56 this was on 274 students. Thus, only a small portion of participants are represented in this  
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3 data. 'Long-term' in this sense encompasses follow up within one year. No studies provided  
4 follow up data beyond this point, a limitation of all included studies. None of the included  
5 studies compared the impact of small vs large scale interventions, meaning that, although  
6 most interventions were effective, it is unknown whether large- or small-scale teaching or  
7 eLearning interventions are more effective in instilling palliative care knowledge.  
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### 15 **Future work**

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17 Our review highlights the need for future research to evaluate the differential impact of small  
18 and large interventions, whether interventions elicit behavioural changes, and the impact of  
19 teaching upon clinical practice during long-term follow-up. Impact of teaching upon patient  
20 care also requires study and could be based on markers of clinical assessment, management,  
21 and patient/family feedback.  
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### 30 **Conclusions**

31  
32 Most types of palliative care teaching interventions conducted with medical students  
33 improve knowledge. This provides useful information for medical schools when considering  
34 the teaching they currently provide, or aim to provide, in the future. The effect of  
35 undergraduate palliative care teaching on clinical practice has not been studied and  
36 warrants investigation. For all teaching approaches, constructive alignment and the  
37 communication of constructive alignment in educational studies should be considered to  
38 ensure adequate teaching impact. Further research into palliative care teaching should  
39 explicitly detail this alignment to allow for evaluation as to whether constructive alignment,  
40 not the teaching method, may be responsible for any effect of palliative care teaching  
41 interventions.  
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51 Medical students can learn about palliative care using a variety of methods; there is no  
52 definitive 'best' way to learn about palliative care. We have the responsibility to not just  
53 train medical students to pass exams, but to be safe and knowledgeable doctors. Given this,  
54 future research needs to assess the effect of teaching on clinical practice, including some  
55 analysis of patient related outcomes, in order to discern the real-world impact of palliative  
56 care teaching interventions.  
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### **Contributors**

JWB designed the study, performed the searches, led on data collection, data analysis and drafted the article. MELB and AND contributed to data collection, data analysis and writing of the article. JG and GMF contributed to study design, analysis and writing of the article. All authors were responsible for approval of the final report.

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### **Conflict of interest**

All authors declare that there are no conflicts of interest.

### **Data availability statement**

All data relevant to the study are included in the article or uploaded as supplementary information

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3 **Figure legends**  
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5 **Figure 1: PRISMA flow diagram**  
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7 **Figure 2: Kirkpatrick's Four-Level Training Evaluation Model.** Reproduced from <sup>41</sup>.  
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For peer review only

Embase	BMJ Open	723
Ovid MEDLINE		420
PsycINFO		219
Web of Science		211
ClinicalTrials.gov		0
ISRCTN registry		0
Cochrane Database of Systematic Reviews (protocols)		7
Cochrane Database of Systematic Reviews		67
Cochrane Central Register of Controlled Trials		25
Health Management Information Consortium (HMIC)		28
Bielefeld Academic Search Engine (BASE)		321
OpenGrey		4
Mednar		20

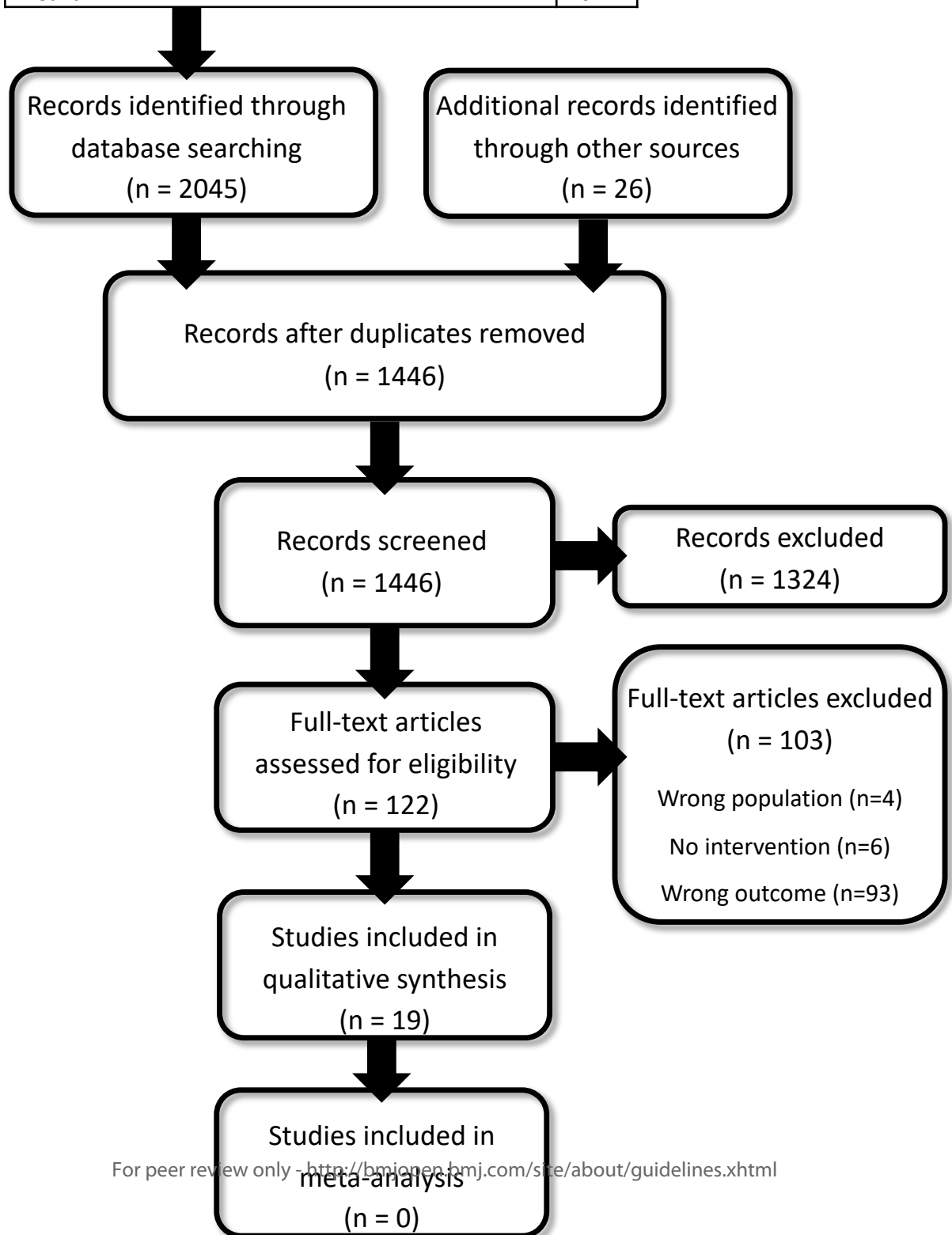
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**Identification**

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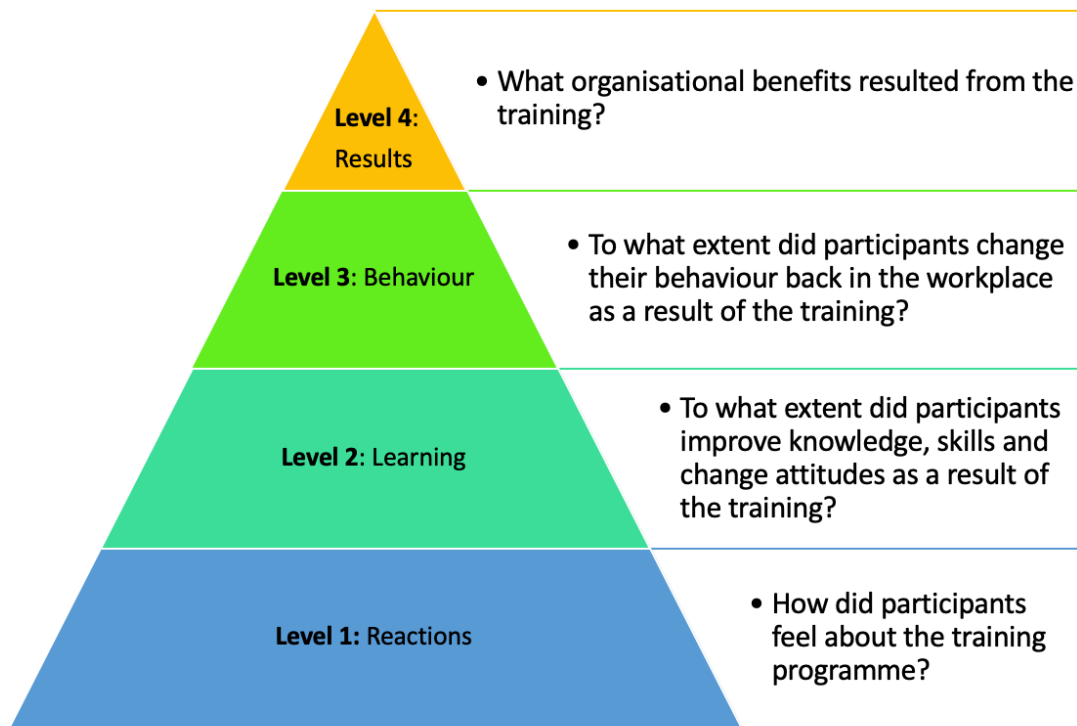


Figure 2: Kirkpatrick's Four-Level Training Evaluation Model. Reproduced from (38).



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9 2 terminally ill patient/ (7790)  
10 3 "death and dying"/ (6)  
11 4 (palliative care or palliative treatment or palliative therapy or palliation).mp. (126295)  
12 5 (terminal care or "end of life care" or hospice\$.mp. (59049)  
13 6 terminally ill patient\$.mp. (9517)  
14 7 (patient\$ adj3 (dying or "close to death" or "end of life")).mp. (12999)  
15 8 or/1-7 (189680)  
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17 10 undergraduate student/ (6077)  
18 11 9 and 10 (819)  
19 12 (med\$ adj3 undergrad\$.mp. (9623)  
20 13 Students, Medical/ (54203)  
21 14 medical student\$.mp. (78609)  
22 15 medical school/ (56832)  
23 16 medical school\$.mp. (75373)  
24 17 or/11-16 (134462)  
25 18 8 and 17 (1964)  
26 19 exp Teaching/ (89532)  
27 20 (teach\$ or learn\$ or lecture\$ or small group\$ or reflection or reflective or pedagogy or  
28 workshop\$ or online or virtual or quiz or video).mp. (1328890)  
29 21 pedagogic\$.mp. (8113)  
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32 24 academic achievement/ or professional competence/ or clinical competence/ or self-  
33 evaluation/ (153355)  
34 25 (outcome\$ or effective\$ or confidence or confident or knowledge or success\$ or fail\$ or fear  
35 or thanatophobi\$.mp. (8513098)  
36 26 palliative care scale.mp. (20)  
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# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4 (table 1)
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	5



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	6
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	6 (table 2)
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	6
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	8
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	9
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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# BMJ Open

## How effective is undergraduate palliative care teaching for medical students? A systematic literature review

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# How effective is undergraduate palliative care teaching for medical students?

## A systematic literature review

**Running head:** Palliative care teaching for medical students

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## Abstract

Palliative care is central to the role of all clinical doctors. There is variability in the amount and type of teaching about palliative care at undergraduate level. Time allocated for such teaching within the undergraduate medical curricula remains scarce. Given this, the effectiveness of palliative care teaching needs to be known.

**Objectives:** To evaluate the effectiveness of palliative care teaching for undergraduate medical students.

**Design:** A systematic review (PROSPERO registration CRD42018115257) was prepared according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidance. Screening, data extraction, and quality assessment (mixed methods and Cochrane risk of bias tool) were performed in duplicate.

**Data Sources:** Embase; MEDLINE; PsycINFO; Web of Science; ClinicalTrials.gov; Cochrane, and grey literature in August 2019. Studies evaluating palliative care teaching interventions with medical students were included.

**Results:** 1446 titles/abstracts and 122 full text articles were screened. 19 studies were included with 3253 participants. 17 of the varied methods palliative care teaching interventions improved knowledge outcomes. The effect of teaching on clinical practice and patient outcomes was not evaluated in any study.

**Conclusions:** The majority of palliative care teaching interventions reviewed improved knowledge of medical students. The studies did not show one type of teaching method to be better than others, and thus no “best way” to provide teaching about palliative care was identified. High quality, comparative research is needed to further understand effectiveness of palliative care teaching on patient care/clinical practice/outcomes in the short and longer term.

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2  
3 **Funding:** None  
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5 **Registration:** PROSPERO, CRD42018115257  
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10 **Article Summary: Strengths and limitations of the review**  
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- 12
- 13 • This was a rigorously conducted systematic review, including “grey” literature, which  
14 evaluated the quality of included studies.  
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  - 16 • Studies using objective measures of assessment were included; with studies only  
17 reporting subjective assessments, self-reports and opinions of participants being  
18 excluded. Studies using external ratings as assessment of students were included.  
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  - 20 • Even using a systematic approach, it remains possible some studies might have been  
21 missed.  
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  - 23 • Publication bias is possible, as studies yielding negative results are less likely to be  
24 published and, although ‘grey’ literature was searched, this may not have fully  
25 captured unpublished works.  
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  - 27 • In view of the variability in interventions and outcomes between included studies, a  
28 meta-analysis was not possible.  
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42 **Keywords:**  
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45 Palliative care; palliative medicine; hospitals, teaching; teaching; systematic review;  
46 education, medical; education, medical, undergraduate.  
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## BACKGROUND

Palliative care is the holistic care of people with advanced, incurable illnesses, and their families.<sup>1</sup> The spectrum of patients receiving palliative care is wide reaching, and ranges from care at the point of incurable illness diagnosis, to the care of dying patients.<sup>1</sup> Palliative care is interdisciplinary in nature and involves: symptom control; information sharing with patients; advance care planning; coordination of interdisciplinary input; and care for the families of patients.<sup>2</sup> The literature informs us these are the key areas which are deemed important to patients when diagnosed with an advanced and incurable illness.

Medical students and doctors require the appropriate knowledge, skills and attitudes to care for patients who have an advanced and incurable illness. For example, in the United Kingdom, it is estimated in their first year of working, newly qualified Foundation Year 1 (FY1) doctors will care for approximately 40 dying patients, and a further 120 patients who are in the last months of life.<sup>3</sup> The ability to care for, and communicate appropriately with these patients and their families is an essential skill for all doctors.<sup>4</sup>

Current medical curricula are saturated,<sup>5</sup> and competition for teaching time is fierce. There is an increased drive to incorporate palliative care teaching into medical schools,<sup>6</sup> in the hope to improve care for patients. Greater integration of palliative care teaching represents the acknowledgment that care of these patients and those who are dying has room for improvement. Furthermore, an aging, multimorbid population and a growth in the diversity of palliative treatment options also contribute to the surge in recognition of palliative care's importance.<sup>7, 8</sup> Given this increased drive to incorporate palliative care teaching, we need to ensure there is an evidence-base around its effectiveness as justification for its inclusion and/or how to best use this time. Despite this, no contemporary examination of palliative care-related teaching methods exists. The efficacy of various methods has not been recently evaluated, and it is therefore difficult to conclude which methods infer the most benefit upon medical students.

## AIM

The overall aim of this review was to evaluate the effectiveness of palliative care teaching upon medical students.

## METHODS

This systematic review was designed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Protocol 2015 guidance,<sup>9</sup> and registered with International Prospective Register of Systematic Reviews (PROSPERO, CRD42018115257). It is reported according to PRISMA guidelines.<sup>10</sup>

### *Search strategy*

A search and associated terms were developed with an information science specialist to determine the best search strategy. Studies of palliative care teaching were searched using the terms “palliative care,” “medical student,” “Education, Medical, Undergraduate” and “teaching”. To increase sensitivity, Medical Subject Headings (MeSH) terms and free text terms were used in searches using the electronic databases Embase (Ovid); Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations; PsycINFO (Ovid); Conference Proceedings Citation Index–Science (Web Of Science; Thomson Reuters, New York City, NY); ClinicalTrials.gov (US NIH); ISRCTN registry (BMC); Cochrane Database of Systematic Reviews (Wiley); Cochrane Central Register of Controlled Trials (Wiley); and Health Management Information Consortium (HMIC) (Ovid). Searches were also conducted for grey literature using the following online databases: the Bielefeld Academic Search Engine (BASE) (<https://www.base-search.net/>), OpenGrey (<http://www.opengrey.eu/>), and Mednar (<https://mednar.com/>). The Embase search strategy is included as a supplementary file. Search strategies from all other databases are available on request from the authors. Searches were carried out on 06/08/2019.

Reference lists of relevant articles (included studies and reviews) were hand searched.<sup>11</sup> Authors’ personal files were also searched to make sure that all relevant material has been captured. Finally, we circulated a bibliography of the included articles to the systematic review team, as well as to scholarship palliative care clinicians’ experts identified by the team, to ensure any relevant literature was not missed.

### **Eligibility criteria**

Studies evaluating a palliative care teaching intervention directed towards medical students were included (Table 1). Where there were mixed study populations and data, studies were only included if data on medical students could be individually extrapolated. To be included, studies needed to demonstrate an objective measure of knowledge or skills (e.g. a test score); studies with only self-opinion/self-perspective, reflective essays and qualitative outcomes were excluded.

Titles/abstracts and full-text papers were independently screened against pre-defined eligibility criteria (table 1) by two reviewers (J.B. and either A.D./M.B.). Disagreement at all stages was resolved by consensus and/or with a third reviewer (either J.B., A.D./M.B.). The results of the searches were shown in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1).

**Table 1: Eligibility criteria for inclusion or exclusion based on key study criteria.**

<b>Study Design:</b>	
Inclusion:	Exclusion:
Randomized studies, non-randomised studies, cluster studies, before and after studies, cohort studies, observational studies, case-control studies and narrative research studies.	Case studies. Opinion pieces (commentaries, letters, editorials).
<b>Participants:</b>	
Studies in medical students. There were no exclusions based on age or course type.	
<b>Interventions:</b>	
Studies of any type education were considered for inclusion. This included but was not limited to Online (lectures, videos, quiz), workshops, lectures, small group teaching, bedside teaching, reflection, reflective essays.	
<b>Comparators:</b>	
Any comparators were considered for inclusion. Likely to be no, different, or less education.	
<b>Outcomes:</b>	

Any outcome measure assessing the effectiveness of palliative care learning and teaching. These might relate to competence/skills, and/or knowledge, and include but not limited to, exam scores.	Studies with only student's self-opinion/self-perspective, reflective essays and qualitative outcomes were excluded as the primary interest was objective measures of effects of palliative care teaching interventions.
<b>Timing:</b>	
No restrictions on length of follow up after the teaching was delivered to medical students.	
<b>Setting:</b>	
No restrictions by country or education setting (providing it was to medical students).	
<b>Date:</b>	
Be no restrictions by date.	
<b>Language:</b>	
No language restrictions for searching studies. Non-English language papers were included in the review and every attempt was made to translate all included foreign language papers. However, if translation was not possible, this was recorded.	
<b>Publication status:</b>	
Published as well as unpublished work was searched for and considered for inclusion. If only an abstract was available, the authors were contacted to attain further information from their study.	

### **Data extraction**

Data were extracted in duplicate (J.B. and either A.D./M.B.) for the aim, study setting, design, population included, educational intervention and comparator, assessment method used, outcomes, Kirkpatrick Model level,<sup>12</sup> study quality, strengths/limitations and ideas for further research (determined by the study authors and reviewers) onto pre-prepared templates.

### **Quality assessment**

The methodological quality of each study was independently assessed by at least two reviewers (JB and either AD/MB). Disagreement was resolved by consensus and/or with a third reviewer (either A.D. or M.B.). The mixed methods appraisal tool (MMAT) was used if

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2  
3 the study was mixed methods<sup>13</sup> and Cochrane risk of bias tool was used if a study was  
4 quantitative.<sup>14</sup>  
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7 The MMAT is a critical appraisal tool developed to evaluate studies using both qualitative  
8 and quantitative data.<sup>15</sup> MMAT was used in line with its original purpose, to appraise mixed  
9 methods research and to evaluate non-randomised quantitative research. Two screening  
10 questions are asked, before progression to more detailed analysis:  
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- 14 1. Are there clear research questions?
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- 16 2. Do the collected data allow to address the research questions?
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20 In this review, the answer to both of these questions had to be 'yes' for a study to qualify for  
21 inclusion. Evaluation using MMAT subsequently focused most heavily on appraising  
22 methodology, assessing five core criteria for each study type. These core criteria can be  
23 reviewed in detail, with additional usage guidance, using the 2018 iteration of the MMAT  
24 tool.<sup>15</sup> To aid interpretation of what was meant by the core quality criteria, the research  
25 team referred to this expanded guidance. A summary of the core criteria for mixed methods  
26 research and nonrandomised quantitative research, the ways in which the MMAT was used  
27 in this work, are listed in table 2.  
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Study design	Core quality criteria
Mixed-methods research	1, Is there an adequate rationale for using a mixed methods design to address the research question? 2. Are the different components of the study effectively integrated to answer the research question? 3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted? 4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? 5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Non-randomised quantitative research	1. Are the participants representative of the target population? 2. Are measurements appropriate regarding

	<p>both the outcome and intervention (or exposure)?</p> <p>3. Are there complete outcome data?</p> <p>4. Are the confounders accounted for in the design and analysis?</p> <p>5. During the study period, is the intervention administered (or exposure occurred) as intended?</p>
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Table 2: Summary of MMAT core quality criteria for mixed-methods and non-randomised quantitative research, adapted from Hong et al.<sup>15</sup> NB: when criteria 5 of mixed-methods research references adhering to the quality criteria of each method involved, it references the quality criteria listed in other sections of the MMAT of the individual methods used, e.g. the quality criteria for non-randomised quantitative research. This research followed this guidance.

The Cochrane risk of bias tool was used to appraise any randomised trial studies; as it is the gold-standard for such evaluation.<sup>14</sup> The Cochrane risk of bias tool has more stringent appraisal criteria, focusing on evaluating the presence of several types of bias: selection bias; performance bias; detection bias; attrition bias; reporting bias; and other bias. The plausible bias within studies deemed 'low risk' were unlikely to seriously alter results and therefore be accepted. Studies at medium risk of bias imply 'some confidence that the results represent true effect'. Despite medium risk, the issues with these studies are 'not sufficient to invalidate results'; these studies were therefore included in our review unproblematically.<sup>16</sup> Studies rated as high risk of bias should be considered sceptically.

### ***Data analysis and synthesis***

Due to the heterogeneity of results, a narrative data synthesis was performed. A team of researchers were involved in the synthesis and development of themes, and analysis of potential biases and quality. Four stages took part with all members of the research team: (1) development of a theoretical model, (2) preliminary synthesis, (3) exploration of relationships in the data (4) and assessing the robustness of the final synthesis.<sup>17</sup>

## Patient and Public Involvement

Patients and public were not involved in in the planning or design of this systematic review.

## RESULTS

The search identified 1446 titles and abstracts for initial screening against the study's eligibility criteria. Following this, 122 full text articles were screened in detail for eligibility. 19 studies were included. The total number of participants in the 19 studies was 3595, data were gained and used from 3253 participants, with long-term follow-up data (up to 1 year) in 274 participants (from 3 studies). Publication dates were between 2002 and 2018. The number of participants in the included studies ranged from 40 to 670; with a mean of 171.2 participants per study (table 3).

### *Quality appraisal*

The quality of mixed methods studies were assessed using the MMAT (n=11),<sup>13</sup> and purely quantitative studies using a trial type of methodology were assessed using Cochrane risk of bias tool (n=8).<sup>14</sup>

Overall the 11 mixed method studies included met all required components of quality using the MMAT (table 3).

The Cochrane risk of bias tool was used to appraise any randomised trial studies. Included studies showed a range of bias; 1 was high risk of bias, 5 were medium risk of bias and 2 were low risk of bias (table 3).

Table 3: Data extraction table

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Auret 2008 Australia	Identify if a structured clinical instruction module improves students self-rated confidence	Pre & post-test design.	91 6 <sup>th</sup> year medical students  (91/106 students: response rate=86%)  Follow-up questionnaire at end of academic year: 30/109 students (response rate=28%)	2 hour Structured Clinical Instruction Module - nine 15minute stations. 4 groups of 30-35 students (in groups of 4).  Taught by 1 palliative care consultant + team of nurses/doctors / pharmacist	Acted as own comparator, pre- & post test	Questionnaire – 6-point Likert scale. Pre workshop, immediately post workshop + follow-up at end of academic year	Improved knowledge and skill post workshop. Poor rate of completion of follow-up, but sustained improvement.	2a	Assessed using Cochrane risk of bias tool, medium risk of bias. Risk of attrition bias- 86% initial completion rate dropped to 28% completion at end of academic year. Reasons not fully explored.	Strengths- required less facilitators than some other interventions, 'practical feel'. Limitations- no statistical reporting, poor response to longer-term follow-up minimising evaluation of knowledge retention.	To formally test knowledge and skill competence following workshop
Brand 2012 Australia	Evaluate students' knowledge, attitudes and experience of a palliative care education programme in a graduate entry medical setting	Pre & post-test design knowledge and Self-Efficacy in Palliative Care	62 2 <sup>nd</sup> year graduate med students. 40/62 (64.5%) completed both the pre- and the post-test  Taught by 4 palliative care consultants + 4 registrars	8 hours palliative teaching within 100-hour oncology curriculum. 5 week oncology/ palliative care block. Lectures, PBL sessions, bedside/clinic tutorials, visit to inpatient unit, self-directed reading.	Acted as own comparator, pre-test & post test	Multiple choice question knowledge test, 2 validated attitudinal scales, student feedback survey (Likert scale + open ended questions)	No statistical significance in mean improvement in knowledge. Subset statistical improvement in symptom management (p=0.001). improvements in attitudes towards communication, symptom management and MDT care	2b	Assessed using mixed methods tool- passed all components.	Strengths: Mixed methods study. Limitations: Possible selection bias – only 64.5% completed pre and post tests and 42% response rate to student evaluation questionnaire, multiple choice questions weren't independently validated.	No



Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Brownfield 2009 USA	Examine the feasibility of a 1-week palliative care course incorporated into the medicine clerkship; knowledge and attitudinal changes in students who had completed the course.	Pre & post-test design	84 Third year medical students.  53/84 (63%) students completed both pre- and post-tests	1-week palliative care curriculum during a 1-year period. Included in-patient and out-patient care, MDT rounds, reflection and didactic teaching around core clinical topics.	Acted as own comparator, pre-test & post test	Survey of attitudes towards palliative care and pre- and post-course measurements of knowledge.	Statistically significant improvement in knowledge scores (pre-course mean scores 145/230 and 175/230 post-intervention (P<0.01). Improved attitudes.	2b	Assessed using mixed methods tool- passed all components.	Strengths- mixed methods study.  Limitations- 63% response rate even to knowledge tests- response bias.	No
Chang 2009 China (inc Taiwan).	Evaluate the effect of a multimodal teaching program on preclinical medical students' knowledge of palliative care and their beliefs relating to ethical decision-making.	Pre & post-test design	118 third year medical students- 'pre-clinical' in Taiwan as medicine is a 6-year degree. Voluntary participation.  Taught by palliative care doctors, clinical social workers, chaplain, nurse practitioner/nurse lead for palliative care.	1 week, end of life care curriculum developed. 3 learning modules. Included bedside teaching, lecture series and small group discussion.	Acted as own comparator, pre-test & post test	Assessed knowledge + beliefs regarding decision making. Instrument constructed based on literature review and national guidance. Validated for use by content expert and tested for reliability- items not meeting reliability statistical cut off excluded.	Improved knowledge following intervention by 14.7% (p<0.001). Clinical management knowledge improved the most. Some improvement in beliefs regarding decision making but not universal.	2b	Assessed using Cochrane risk of bias tool- Medium risk of bias. Selection bias likely to be present- students were volunteers, risking self-selection bias. 100% response rate- no attrition bias.	Strengths- validated test tool.  Limitations- only 18/32 knowledge items reliable enough for inclusion. Knowledge questions were true/false/not sure. Follow up immediately after intervention, not testing long-term retention of knowledge.	None discussed
Day 2015 USA	Compare the effect of eLearning	Quasi-randomized controlled	119 Third year medical students.	Interactive e-learning: eDoctoring on	26 Small group sessions on	Pre-test and post-test	Both groups- knowledge questions	2b	Assessed using Cochrane risk	Strengths- quasi-randomised	No

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	versus small-group learning	trial of web-based interactive education (eDoctoring) compared to small-group education (Doctoring)	eDoctoring (n = 48) or small-group Doctoring (n = 71).	palliative care clinical content over two months.  No faculty input whilst taking the course.  Small group teaching for 3 hrs on communication skills. Year-long course.	palliative/end of life care.  Small group teaching for 3 hrs on communication skills. Year-long course (same as intervention arm).	questionnaires. 27 self-efficacy questions-rating confidence. 6 single best answer knowledge questions relating to curriculum covered by modules completed in eDoctoring.	improved post-test, non-statistical trend present favouring the eDoctoring students. in self-efficacy ratings in both intervention and control, with no differences in improved between the groups.		of bias tool. Medium risk of bias. Quasi-randomised, low selection bias. Attrition bias possible-more dropouts in Doctoring arm (results excluded from analysis) - reasons not explored.	Limitations-. No long-term measures in knowledge retention. Randomisation did not include technology fluency or viewpoints.	
Dorner 2014 Germany	Explore the feasibility of peer teaching for communication skills training.	Pre & post-test study	37/49 (76%) medical students in in the fourth to sixth of medical school. Voluntary participation open to all medical students  Tutors- Fifth & sixth year medical students trained by faculty to deliver teaching.	90-minute peer taught workshop teaching 9 core communication skills regarding palliative and end of life care, particularly within the intensive care unit. Case based discussions and role play both used.	Own comparator, pre-test & post test	External 'intensivist' rated students based on a taped role play they conducted with another student. Qualitative analysis of transcripts to see how students spoke about death. Self-rated skills scores.	Self-rating scores improved following intervention (P<0.001). Mean expert ratings did not differ from student's own assessment of performance or skills except in one domain	2b	Assessed using mixed methods tool-passed all points.	Strengths- peer teaching affordable and easily scalable. Limitations- lacks long term evaluation	Further work required regarding student's ability to use the word 'death'.
Ellman 2016 USA	Evaluate four-year curriculum in palliative care.	Mixed-method evaluation	First to fourth year medical students. 95 students in the implementation year	4-year longitudinal, integrated curriculum. Included workshops,	Comparator only for graduating student surveys-compared	Competency in a palliative care OSCE station at the end of the curriculum.	In implementation year, average score 74% in OSCE palliative care station-	2b	Assessed using mixed methods tool-passed all points.	Strengths: mixed methods study, curriculum is well integrated	In order to evaluate longer term effect of curriculum, team are planning a

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
				hospice experience, modules, communication skills and a year 4 palliative care observed structured clinical examination (OSCE) station. 2 hours in 1 <sup>st</sup> year; 4 hours in 2 <sup>nd</sup> year; 15-23 hours in 3 <sup>rd</sup> year; 4 hours in 4 <sup>th</sup> year.	with national Association of American Medical Colleges questionnaire of US medical schools regarding confidence with palliative care.	Analysis of student written reflections. Graduating student surveys-regarding how prepared students felt following course.	lower than average score for other OSCE stations (84%) but felt to be 'acceptable'. Students undertaking 4-year curriculum felt more prepared in palliative care compared with other US medical schools.			and longitudinal. Limitations- no long term follow up data, OSCE station on palliative care scored lower still than OSCE stations on other subjects	survey of former students now in postgraduate training.
Gerlach 2015 Germany	Evaluate the effects of the Mainz undergraduate palliative care education (UPCE) on students' self-confidence regarding important domains in palliative care.	Prospective questionnaire-based cohort study with a pre-post design. Knowledge test only at end of module	329 Fifth year medical students. All students took knowledge test.  156 (47%) students completed matched surveys at both points of measurement  Facilitators: physicians, palliative care nurses, bereaved family members.	Mandatory palliative care module over one term. 7x90 minute sessions. Included pain lecture hospice home care through use of videoed live interview with bereaved family member. Small group discussion.	Knowledge scores: historic test scores from before the intervention within Mainz examined-same test so comparison is likely acceptable. Self-confidence scores, comparison with cohort from 2011 in Mainz who did not receive module.	Multiple choice electronic knowledge exam after module- 21 item, single best choice answer. Pre and post testing of students' self-confidence.	All passed knowledge exam, average scores >90%. Compared to historic cohort: increased in correct answers for pain (40%), symptom control (69%), and psychosocial knowledge (33%). Self-reported confidence improved.	2b	Assessed using Cochrane risk of bias tool. Medium risk of bias. Attrition bias: 47% of surveys matched for pre-and post-test results, so data lost. Reasons are clear-incomplete form completion, effect of this is unclear.	Strengths- Intervention acceptable, enjoyed interdisciplinary input. Limitations: only 47% of surveys pre and post intervention matched and used (due to local policy), unknown if increases in knowledge and self-confidence are linked.	Whether or not the course provided only an instant or a long-term effect-research underway. Further research needed regarding any effect on patient outcomes.
Goldberg 2011 USA	To assess the effect of a required	Historical control trial.	117 Fourth year medical students	N=59 (51% of students from class of 2008)	N=58 (55% of students from class of 2007)	Survey: self-rated skills performance	No statistical difference in mean scores	2b	Assessed using mixed methods tool-	Strengths: mixed-methods	Further research into qualitative

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	clinical rotation in palliative medicine		(month prior to graduation)  Taught by 2 interdisciplinary teams, each with an: attending physician, fellow in palliative med/geriatrics /oncology, a nurse practitioner, & a social worker staff (clinical team portion) + social worker, chaplain, & massage therapist	Addition of a required 1-week clinical rotation in palliative medicine (integrated in 12-week IM-Geriatrics clerkship) – multiple venues, time spent with consult team + formal didactic lectures on palliative care issues	= historical control group (received didactics but no clinical rotation in palliative medicine)	& interest, student educational experience, 30-question MCQ exam  2008 cohort also had 2 open-ended questions  Components of Association of American Medical Colleges annual graduate questionnaire	for knowledge questions  Higher skills self-ratings in 2008 cohort  Association of American Medical Colleges questionnaire: 2008 cohort more experience in palliative care		passed all points.	study, utilised historical control group  Limitations: Diversity of exposure with clinical rotations, not controllable	findings – how might reported skills be applied  Exploring different venues of palliative care (outpatient) for clinical rotations
Green 2010 USA	Pilot study evaluating the effectiveness of a computer-based decision aid for teaching medical students about advance care planning.	Prospective, randomized controlled design	133 Second year medical students.  121/133 (91%) of students agreed to have their data used in study - 60 in the Decision Aid Group and 61 in the Standard Group.	Computer based decision aid for student use to help patients with advanced care planning (to help patient complete advance directive). Multimedia tool, uses educational material and exercises to help patient clarify values and priorities, help students explain end of life conditions and	Prior to intervention all students received instruction in advanced care planning-lectures, reading material, small group discussion.	Knowledge assessed using a 17-item true/false and MCQ. Self-rated satisfaction, confidence and perceived knowledge of patient wishes. Patients' evaluation of student assessed using 12-items addressing students' communication skills, helpfulness, and perceived	High baseline knowledge for advance care planning. Students in decision aid group more improved (84% to 88%, p<0.01) Student confidence increased following interventions in both groups but more in decision aid group. Student satisfaction higher in	3	Assessed using Cochrane risk of bias tool. High risk of bias. No discussion of how students were randomised so unclear if selection bias is present. patient bias-students were responsible for recruiting patients and these were eligible to be family/friends	Strengths- tool easy to roll out and applicable within other institutions. High levels of student and patient satisfaction. Limitations- pilot study so not powered. Selection of patients determined by students. No full data regarding student interactions with patients, time spent. Confounding	National study comparing this computer programme with current approaches to advance care planning.

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
				treatments and then helps synthesise this into an advance directive.		understanding of their wishes. Patients' satisfaction assessed by measure of global satisfaction	decision aid group. Patients significantly more satisfied with student performance and global impression in decision aid group.		- patient rating scales may well be biased.	factors within this that could have impacted results. Measures used within the study not validated.	
Jackson 2002 USA	Evaluate a palliative medicine curriculum developed for medical students in the required third-year clerkship in family medicine at the University of Tennessee.	Pre & post-test design with the post-test assessment seven weeks later.	69 Third year medical students on their family medicine clerkship	Four-hour curriculum. Prior to session students were sent reading concerning palliative care. During session-discussion, role play, information giving via PowerPoint and lecture.	Acted as own comparator, pre-test & post test	20 item pre-test and post-test for palliative care knowledge. One item confidence question regarding palliative care clinical skills.	Significant knowledge gain post-test (37% pre-test to 55% post-test); (p<0.0001). Small but statistically significant increase in self-reported confidence (p=0.031).	2b	Assessed using Cochrane risk of bias tool. No bias noted in any domains. Low risk of bias.	Strengths- Popular with students on course evaluation-. Limitations- other palliative care education at institution.	long-term retention of knowledge and the development of instruments to measure the translation of a theoretical knowledge base into actual clinical skill sets.
Paneduro 2014 Canada	Develop and evaluate a pain management & palliative care seminar for medical students during surgical clerkship	Pre & post-test design with the post-test assessment at 1 year	292 Third & Fourth year medical students in surgical clerkship  95% (n=277) completed post-test immediately following the seminar and 31% (n=90) completed the	4-hour seminar on pain management and palliative care  Taught by faculty from pain medicine, surgery & palliative care	Acted as own comparator, pre-test & post test	10-item knowledge test  Comments on seminar	Significant knowledge improved; maintained at 1 year. mean pre-test, post-test and one-year follow-up test scores were 51%, 75% and 73%, respectively.  No difference between 3 <sup>rd</sup> &	2b	Assessed using mixed methods tool-passed all points.	Strength: Relatively short items to respond to in order to facilitate participant, collaboratively designed seminar  Limitations: high attrition rate at 1 year. Hard to	Modify seminar to better target attitudes/beliefs

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
			follow-up test via e-mail.				4 <sup>th</sup> year students			control for seminar impact specifically, at long-term follow-up	
Poter- Williamson 2004 USA	Assess impact of a hospice curriculum for medical students, in terms of knowledge, skills, & attitudes	Pre & post- test study	127 Third year medical students	32-hour, 4-day curriculum	Acted as own comparator, pre-test & post test	26-item self- assessment of competency, a 20-item self- report of concerns, a 50-item MCQ knowledge test, & qualitative assessment of course curriculum	23% improved knowledge 56% improved competence 29% improved for concerns (all p<0.0001). No changes for attitudes (p=0.35) (already had appropriate attitudes)	2b	Assessed using mixed methods tool- passed all points.	Strength: multiple measures of curricular evaluation, curriculum could be applied at other universities  Limitations: no long-term follow-up	link specific clinical encounters with clinical knowledge changes, for explanation; longitudinal re- examining
Shultz- Quach 2018 Germany	Evaluate an eLearning course “Palliative Care Basics” in terms of student acceptance, exam performance, and competence	Cross- sectional study	670 Undergraduate medical students (3 cohorts). 569 (96%) used eLearning as preparation for the exam; 23 did not.	eLearning course (5 teachings domains over 10 teaching units). Virtual patient contact, didactic teaching, e- lectures, patient case vignettes	Students who did not access the eLearning course. 23 students	Questionnaire of self- assessment  Course eval, with ratings and free response section  20-item MCQ exam	Knowledge improved (p=0.02). High approval of eLearning tool – easy to approach topics, increased interest,	2b	Assessed using mixed methods tool- passed all points.	Strength: Mixed- methods  Limitations: no baseline measurements , very small comparator group	Further assessment of eLearning tools in blended curriculum
Tai 2014 Australia	Assess whether a 1- week palliative care placement improves student performance	Consecutive cohort Retrospective analysis, pre & post- test mixed methodology	84 Fifth year medical students (who enrolled in palliative care placement).  72 (86%)	1-week palliative care placement  Combination of didactic and interactive tutorials with	Acted as own comparator, pre-test & post test/course	Knowledge based questions (16 MCQs)  Post-course satisfaction ratings (10-	Improved knowledge: average 58% to 74% (P<0.001).  Most reported value of course	2b	Assessed using mixed methods tool- passed all points.	Strength: mixed- methods.  Limitations: measures not validated; reduced	Assess value of different length palliative care placements (1 week might not be enough)

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Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
	& knowledge. Explore student views on palliative care rotation, particular for building confidence		completing both pre- and post-course multiple-choice questions	experiential attachment such as ward rounds		closed item questions + 2 open-ended questions)	and wanted more palliative care education			sample size due to exclusion of students who did not complete both parts of study	
Tan 2013 Canada	Determine whether virtual patient case in palliative care could offer students acceptable alternative to real-life experiences	Mixed methods pre & post-survey	137 Third year medical students  95% (130/137) consented to have their results analyzed. knowledge score assessed in 127	Virtual patient clinical case, mandatory exercise in family medicine rotation  Average time spent with virtual patient case = 0.93 hours, SD=0.65	Acted as own comparator, pre-test & post test	Knowledge test & level-of-preparedness survey (self-assessment of clinical skills), plus student feedback on virtual patient case/usage & general feedback	Knowledge scores increased (48-63%; p<0.001)  virtual patient case was realistic (91%), and educational (86%)  Students spending >20 minutes on case reported more engagement	2b	Assessed using mixed methods tool-passed all points.	Strength: mixed-methods approach for evaluation  Limitations: hard to correlate time spent on case with outcomes, limited info about students' experiences with real patients	Expanding knowledge component of study to better understand specific changes in knowledge
Tsai 2008 China	Assess the impact of a 4-hour multimodule curriculum on knowledge & attitudes of end of life care	Prospective cross-sectional pre & post- test survey	259 Fifth year medical students	4-hour course included: 1 hour lecture by specialist, 1 hour patient visit at unit, 1 hour literature reading, 1 hour discussion	Acted as own comparator, pre-test & post test	Questions on knowledge, demographics & ethical beliefs	Knowledge improved (55% to 70%) (p<0.0001). Principles of palliative care scores improved (58% to 73%). Clinical management improved (59% to 68%)	2b	Cochrane risk of bias tool-Low risk of bias, no bias evident in any domains.	Strength: easy to implement curriculum. correlation analysis across items  Limitations: hard to control for confounding variables like maturation effect	Further assessment of medical training (residency & clinical practice) – follow up studies  Longitudinal study to better understand changes over time

Author Year country	Aim	Study design	Population	Palliative care teaching intervention	Comparator	Assessment Method	Outcomes	Kirkpatrick Model level	Study Quality	Strengths and limitations	Further research
Tse 2017 USA	Explore the application of online learning tool with hospice experience	Randomised prospective pre & post study	152 Second year medical students completed the survey (response rate 51%)  56% (n=85) completed the online module	Addition of 30 min online module to hospice experience. Taught by hospice care physician or nurse ) in hospice setting	Randomised to receive module prior to hospice experience (YES module) versus after experience (NO module)	23-item electronic survey: 10 attitude-assessing statements from FATCOD, 8 multiple choice knowledge questions	Higher scores on knowledge questions for students completing the online module (p=0.006).  No statistical difference in attitudes	2b	Assessed using Cochrane risk of bias tool, medium risk of bias. self-selection bias as voluntary participation, could suggest already motivated regarding palliative care. Randomisation not described	Strengths-mixed methods study, focused on assessing blended learning experiences  Limitations: Single site study, survey was relatively few items	Expanding scope of study for more institutions (generalisability)  More survey items → more comprehensive assessment
Von Guten 2012 USA	Assess impact, retention, & magnitude of effect of a required didactic & experiential palliative care curriculum	Prospective pre-post study	487 Third year medical students	Specified palliative care curriculum designed for 1 day/week for 4 weeks (during the ambulatory block of the 12-week IM clerkship)  Taught by IM faculty. participation was compulsory	Self-comparator over time (pre-test & post-test).  knowledge compared with national cross-sectional study comparing residents at progressive training levels	36-item knowledge test, self-assessment of competency, & self-assessment of attitudes + written surveys	Knowledge: improved 52% to 67% (national residents, average score 62%). 56% improved confidence (higher than resident national averages). 29% decrease in concern. (All p<0.001).  All maintained at 1 year.	2b	Assessed using mixed methods tool-passed all points.	Strength: mixed methods, assess various levels of effect, national comparison  Limitations: evaluation instruments designed for specific learning objectives of course. Documentation of long-term follow-up unclear	None outlined by study



## ***Context of Included Studies***

### *Demographics*

The selected studies took part in many countries; 9 United States of America (USA), 3 Australia, 3 Germany, 2 Canada and 2 China (including Taiwan).

### *Study designs*

14 of the included studies tested knowledge before and after a teaching intervention, in a pre-post design. The post-test was immediately post intervention in all but 4 studies, with one study conducting its post-test at seven weeks, and the other three at approximately 1-year post intervention. Most of these pre-post designed studies were cohort-type studies; one was randomised, and 3 included a mixed methods design. The other 5 included studies used a randomised controlled design, quasi-randomized controlled trial, historical control trial and 2 cross-sectional design studies (table 3).

### *Types of teaching interventions*

The included studies had a wide variety of teaching methods and teaching hours. The main shared descriptor of palliative care teaching interventions in the included studies was the duration. Studies could be largely summarized as 'small' scale teaching interventions (interventions with a duration of hours), or as 'large' scale teaching interventions (interventions that took place over the course of days). Included studies were categorized into these durations, and durations were decided comparatively by the researchers. In addition to these small and large interventions, a third descriptive category was determined: eLearning interventions. Because the nature of eLearning is often associated with uncertain measures of time (depending on student use outside of learning environment), eLearning interventions were considered to be different than small or large face-to-face teaching interventions. Given the variance in shared descriptors, the decision was made to synthesise results based on the type of intervention: small, large, or eLearning.

### *Different assessment methods*

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3 The studies used different assessment methods and some studies used multiple methods of  
4 assessment (table 3); this made it difficult to assimilate study outcomes. Most commonly,  
5 multiple choice questions (MCQs) were used to test knowledge<sup>18-24</sup> or a combination of  
6 MCQs and true/false questions.<sup>25</sup> The number of items testing knowledge differed between  
7 studies. These ranged from 6 single best answer items,<sup>26</sup> 8 MCQs<sup>27</sup> to 50 MCQs.<sup>23</sup> Other  
8 methods of assessments included an 'external intensivist' rating student performance based  
9 on a taped role play<sup>28</sup> and observed structured clinical examination (OSCE) station  
10 assessment.<sup>29</sup> Some studies also assessed student attitudes and confidence in a pre-post  
11 format.<sup>19, 21, 24, 25, 27, 30, 31</sup>

## 22 **Synthesis of results**

### 23 *Smaller teaching interventions*

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27 Seven of the included studies evaluated a 'small' palliative care teaching intervention; these  
28 included a range of interventions of different sizes, from 1.5 to 10.5 hours, with a median of  
29 4 hours.<sup>19, 20, 28, 32-35</sup> Six of the seven included studies showed statistically significant  
30 improvements in knowledge assessment outcomes (table 3),<sup>20, 28, 32-35</sup> and one of these  
31 studies included a one-year follow-up, with knowledge retention demonstrated.<sup>33</sup> Although  
32 one study did not show overall improvement in knowledge scores, it did demonstrate  
33 statistically significant improvements in symptom management scores in a subset analysis.<sup>19</sup>

### 34 *Larger teaching interventions*

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38 Seven of the included studies evaluated a 'large' palliative care teaching intervention, with  
39 interventions ranging from 4 to 5 days, with a median of 5 days (table 3). Six of the seven  
40 large scale studies demonstrated statistically significant improvements in knowledge  
41 assessment outcomes; although one of these had a poor comparator.<sup>29</sup> One study failed to  
42 demonstrate an improvement in knowledge from mandatory participation in a clinical  
43 palliative care module compared to didactic teaching alone.<sup>18</sup> There were critical limitations  
44 in the comparator used in the study by Ellman et al.<sup>29</sup> Ellman et al developed a new  
45 palliative care OSCE to assess student knowledge regarding symptom management,  
46 communication, and the psychosocial, spiritual, and cultural aspects of care. Competency in  
47 this OSCE station was deemed adequate by the authors (average score 74%) although the  
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3 level attained at this station was below that of other OSCE stations; which was on average  
4 84%.<sup>29</sup> There was also no pre and post intervention testing, thus it is unclear if this  
5 intervention improved knowledge or not.  
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### 8 *eLearning teaching interventions*

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10 Five studies evaluated the effect of eLearning on knowledge in palliative care, with all these  
11 studies demonstrating statistically significant improvements in knowledge scores (table 3).  
12 The specific type of eLearning varied, but included: a virtual patient clinical case,<sup>36</sup> a  
13 computer-based decision aid for advance care planning content,<sup>25</sup> a flipped classroom  
14 online module coupled with a hospice care experience,<sup>27</sup> and an eLearning course.<sup>22</sup> The  
15 fifth study, an Interactive e-learning course, is notable because it reported equivalence in  
16 increasing knowledge scores, when compared with small-group teaching sessions.<sup>26</sup> Of the  
17 eLearning studies included, this is the only one to provide a comparator to the eLearning  
18 resource. However, the study still considered the eLearning intervention to be 'successful,'  
19 as it was determined to be less faculty intensive to run but imparted the same degree of  
20 knowledge as 'traditional' teaching.<sup>26</sup> Overall, all eLearning interventions offered flexibility  
21 for students.  
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### 33 *Summary*

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35 Overall, the majority (n=17) of the included studies demonstrated an improvement in  
36 knowledge. Small amounts of specific teaching improved knowledge in six out of seven  
37 studies. Similarly, large amounts of teaching improved knowledge in six out of seven studies.  
38 All eLearning interventions improved assessment outcomes in tests of knowledge. No  
39 included study directly compared small and large teaching interventions and, as study  
40 outcomes were heterogenous, it was not possible to evaluate whether small or large  
41 interventions were 'better.'  
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## 52 **DISCUSSION**

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54 This systematic review presents a contemporary overview of the literature regarding the  
55 effectiveness of palliative care teaching to medical students. All types of teaching  
56 intervention (small- and large-scale teaching, clinical and eLearning) improved knowledge  
57 scores for medical students. No method appeared to be superior in improving knowledge.  
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3 Few studies explored knowledge retention, skills or attitudes. No studies explored the  
4 impact of teaching on clinical care for patients. Significant heterogeneity of teaching  
5 approaches continues to exist, and is increasing, as new teaching methods (such as  
6 eLearning) develop and grow in popularity. Further contributing to the heterogeneity was  
7 the inconsistency of overall teaching approaches and methods of assessment in all included  
8 studies. This leads to the hypothesis that, regardless of the style of teaching, improvement  
9 in palliative care knowledge scores is possible following teaching. Study designs, too,  
10 differed significantly, with no consistent approach to long term follow up. In view of the  
11 multifaceted heterogeneity evident in both study design and outcomes, the data gathered  
12 systematically were synthesised narratively.<sup>17</sup>  
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### 24 **Outcomes and constructive alignment considerations**

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26 Examining the intervention efficacy with an educational theory lens was the logical first step  
27 in performing a narrative synthesis of included articles in this particular review. One of the  
28 first theories to consider in any study measuring knowledge via assessment is Biggs' theory  
29 of constructive alignment.<sup>37, 38</sup> Constructive alignment argues that there needs to be  
30 alignment of learning outcomes, teaching methods, and assessment measures, otherwise,  
31 true learning may not occur. For example, if an educator presents learning outcomes to  
32 students related to palliative care, but then teaches a session on dermatology, and gives an  
33 assessment with questions concerning cardiology, you would expect students to not pass  
34 their assessment, and conclude learning did not occur. However, in this admittedly bizarre  
35 example, learning might have occurred; it just may have been related to palliative care, or  
36 most likely dermatology. Yet, because these educational components are not constructively  
37 aligned, it would be impossible to actually comment on learning. This same reasoning can be  
38 applied to the studies included in this review. Many studies determined learning occurred,  
39 as exemplified by improvement in knowledge scores. However, one issue when conducting  
40 this review was the inability to know with any certainty how related teaching and  
41 assessment were to one another. It was not made clear by the analysed studies how  
42 constructively aligned their assessment was to the palliative care teaching delivered. It was  
43 clear that some short interventions were geared to improve a specific aspect of palliative  
44 care (e.g. Advanced care planning),<sup>25</sup> but most larger interventions (where details were  
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3 published and we could discern more exact content of the teaching), covered a range of  
4 topics in the palliative care curriculum. Poor detail regarding the content of assessment, and  
5 limited assessment regimens, makes it seem likely only some of these topics were formally  
6 assessed.  
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11 Failure to explicitly acknowledge constructive alignment within any of the included studies  
12 makes it difficult to accurately assess the efficacy of any (especially the large) teaching  
13 interventions. Reproducibility of the value of the interventions will likely largely depend on  
14 specific variables relating to constructive alignment. Utilisation of constructive alignment in  
15 teaching intervention design and assessment may have been an influencing factor as to  
16 whether an intervention improved knowledge scores. However, without discussion of this in  
17 any of the studies, it is not possible to know whether constructively aligned learning  
18 outcomes, teaching and assessment are important to effective palliative care teaching.  
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### 29 **Impact of Teaching Interventions**

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31 Kirkpatrick's Four-Level Training Evaluation Model is used to evaluate the results of  
32 educational programs, which are divided into 4 levels (figure 2).<sup>12</sup> This model was used to  
33 evaluate the impact of interventions in the included studies.  
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36 Included studies in this review were mostly at level 2 of Kirkpatrick's Four-Level Training  
37 Evaluation Model; what students have learned.<sup>12</sup> The only study to assess Behaviour (Level  
38 3) was by Green et al<sup>25</sup> where patient satisfaction was evaluated in an advance directive  
39 scenario. This introduces the concept that for many of these teaching interventions, their  
40 potential efficacy has really only been assessed from a limited viewpoint. Although changes  
41 in knowledge and attitude are important, they do not guarantee the educational experience  
42 will change behaviour/practice. Measuring the clinical impact of a teaching intervention  
43 requires rigorous long-term follow-up, and such follow up was not performed by any studies  
44 within this review. Thus, no conclusions regarding the impact of these palliative care  
45 teaching interventions upon clinical practice or patient outcomes can be made. This is  
46 particularly important as with growing demands and need for quality palliative care in  
47 practice, it is important to understand if medical school interventions are actually improving  
48 later clinical practice, or long-term decisions of medical students. Studies suggest there are  
49 many misconceptions by lay and healthcare professionals of what palliative care is/hospices  
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3 are, and thus one of the main aims of undergraduate teaching should be to try and dispel  
4 these.<sup>39, 40</sup> This was not explored in any of the studies.  
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### 8 **Heterogeneity might indicate wide possibilities for curricular design**

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10 While the effect of palliative care teaching on clinical practice could not be elucidated from  
11 this review, there was significant information relating to potential knowledge gain and  
12 exposure via palliative care teaching interventions. While there was significant  
13 heterogeneity in how knowledge was measured in these studies, interesting findings were  
14 identified. Both small amounts of specific teaching and larger scale interventions improved  
15 knowledge, which may support the argument that institutions should investigate integrating  
16 some level of teaching palliative care, even if small, as these can prove beneficial to the  
17 knowledge base for students. This is supported by the fact that in these studies, regardless  
18 also of the teaching method, improvement in palliative care knowledge scores was possible  
19 following instruction. Again, this provides more evidence that while there seems to be no  
20 identifiable 'best practice' for teaching palliative care in medical education (as no studies  
21 compared this or asked this question, and knowledge scores used by different studies was  
22 not the same), this means that institutions can adapt from a variety of methods that may  
23 work best for their curriculum.  
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37 eLearning also appeared to improve knowledge scores in studies included in this review.  
38 One study demonstrated the potential value of integrated eLearning with existing clinical  
39 experiences; a small, online module provided to students prior to a hospice experience  
40 demonstrated improved knowledge amongst these students.<sup>27</sup> This study, and the others  
41 relating to eLearning, contribute to the possibility that any type of palliative care teaching  
42 may be very beneficial, even with the need for more focused and detailed research.  
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### 51 **Strengths and limitations of the systematic review**

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53 This is a rigorously conducted systematic review designed using PRISMA Protocol 2015  
54 guidance,<sup>9</sup> and reported according to PRISMA guidelines.<sup>10</sup> It included "grey" literature and  
55 evaluated quality of the studies and impact on clinical practice. However, it is possible some  
56 studies might have been missed and publication bias is possible and if studies were not  
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3 available then they would not have been included. Different reviewer expertise brought  
4 diversity to the team and ensured a multi-angled perspective. The systematic review drew  
5 on the international literature studying medical student education about palliative care. As  
6 such, it is generalisable and applicable to an international audience.  
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11 In view of the variability in interventions and outcomes between included studies a meta-  
12 analysis was not possible, and a narrative synthesis was performed. Risk of bias was  
13 assessed by 2 different tools, depending on the study type. The mixed methods tool was  
14 used if the study was mixed methods as this tool was not applicable to purely quantitative  
15 work.<sup>13</sup> Cochrane risk of bias tool was used if a study was purely quantitative.<sup>14</sup> The  
16 Cochrane risk of bias is designed for RCTs so some aspects of appraisal, like allocation  
17 concealment, often weren't applicable for the included quantitative studies.<sup>14</sup>  
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24 Although this review primarily used objective measure of assessment and excluded  
25 subjective assessments, self-report and opinions of participants. Studies using self-report of  
26 external people were included. External rating is still subjective but is an external outcome  
27 measure.  
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### 34 **Limitations of included studies**

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36 The main limitation of the included studies is that none assessed effect upon clinical  
37 practice and patient outcomes. Thus, the effect on clinical practice of each teaching  
38 intervention is unknown. Only 3 studies undertook follow-up and collected long-term data;  
39 this was on 274 students. Thus, only a small portion of participants are represented in this  
40 data. 'Long-term' in this sense encompasses follow up within one year. No studies provided  
41 follow up data beyond this point, a limitation of all included studies. None of the included  
42 studies compared the impact of small vs large scale interventions, meaning that, although  
43 most interventions were effective, it is unknown whether large- or small-scale teaching or  
44 eLearning interventions are more effective in instilling palliative care knowledge.  
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### 56 **Future work**

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3 Our review highlights the need for future research to evaluate the differential impact of small  
4 and large interventions, whether interventions elicit behavioural changes, and the impact of  
5 teaching upon clinical practice during long-term follow-up. Impact of teaching upon patient  
6 care also requires study and could be based on markers of clinical assessment, management,  
7 and patient/family feedback.  
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## 15 **Conclusions**

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17 Most types of palliative care teaching interventions conducted with medical students  
18 improve knowledge. This provides useful information for medical schools when considering  
19 the teaching they currently provide, or aim to provide, in the future. The effect of  
20 undergraduate palliative care teaching on clinical practice has not been studied and  
21 warrants investigation. For all teaching approaches, constructive alignment and the  
22 communication of constructive alignment in educational studies should be considered to  
23 ensure adequate teaching impact. Further research into palliative care teaching should  
24 explicitly detail this alignment to allow for evaluation as to whether constructive alignment,  
25 not the teaching method, may be responsible for any effect of palliative care teaching  
26 interventions.  
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36 Medical students can learn about palliative care using a variety of methods; there is no  
37 definitive 'best' way to learn about palliative care. We have the responsibility to not just  
38 train medical students to pass exams, but to be safe and knowledgeable doctors. Given this,  
39 future research needs to assess the effect of teaching on clinical practice, including some  
40 analysis of patient related outcomes, in order to discern the real-world impact of palliative  
41 care teaching interventions.  
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### **Contributors**

JWB designed the study, performed the searches, led on data collection, data analysis and drafted the article. MELB and AND contributed to data collection, data analysis and writing of the article. JG and GMF contributed to study design, analysis and writing of the article. All authors were responsible for approval of the final report.

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### **Conflict of interest**

All authors declare that there are no conflicts of interest.

### **Data availability statement**

All data relevant to the study are included in the article or uploaded as supplementary information

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3 **Figure legends**  
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5 **Figure 1: PRISMA flow diagram**  
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7 **Figure 2: Kirkpatrick's Four-Level Training Evaluation Model.** Reproduced from <sup>41</sup>.  
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Embase	BMJ Open	723
Ovid MEDLINE		420
PsycINFO		219
Web of Science		211
ClinicalTrials.gov		0
ISRCTN registry		0
Cochrane Database of Systematic Reviews (protocols)		7
Cochrane Database of Systematic Reviews		67
Cochrane Central Register of Controlled Trials		25
Health Management Information Consortium (HMIC)		28
Bielefeld Academic Search Engine (BASE)		321
OpenGrey		4
Mednar		20

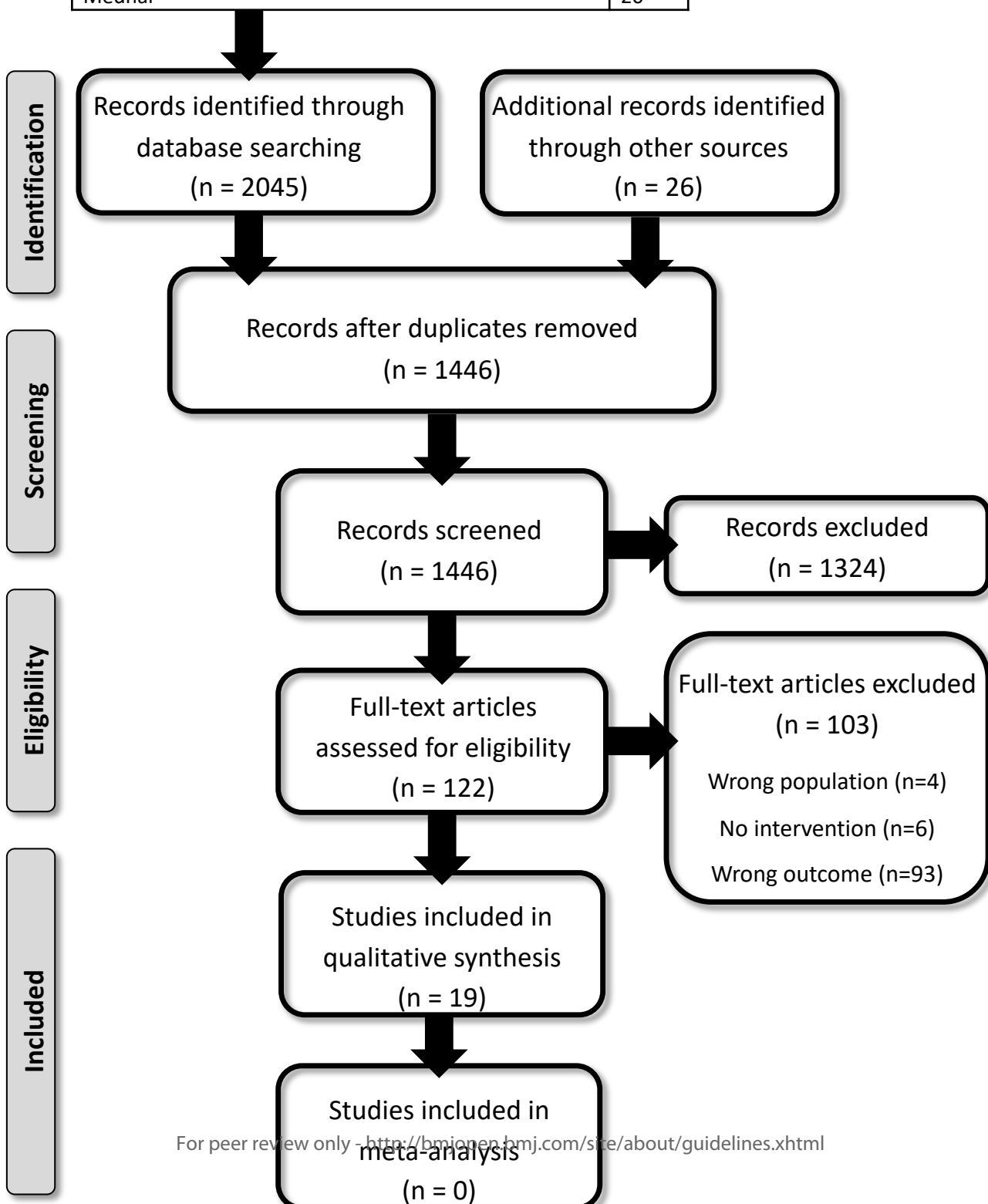




Figure 2: Kirkpatrick's Four-Level Training Evaluation Model. Reproduced from (38).

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5 Search Strategy:  
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- 8 1 exp palliative therapy/ or exp terminal care/ or hospice care/ (157404)
- 9 2 terminally ill patient/ (7790)
- 10 3 "death and dying"/ (6)
- 11 4 (palliative care or palliative treatment or palliative therapy or palliation).mp. (126295)
- 12 5 (terminal care or "end of life care" or hospice\$).mp. (59049)
- 13 6 terminally ill patient\$.mp. (9517)
- 14 7 (patient\$ adj3 (dying or "close to death" or "end of life")).mp. (12999)
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- 17 10 undergraduate student/ (6077)
- 18 11 9 and 10 (819)
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- 21 14 medical student\$.mp. (78609)
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- 25 18 8 and 17 (1964)
- 26 19 exp Teaching/ (89532)
- 27 20 (teach\$ or learn\$ or lecture\$ or small group\$ or reflection or reflective or pedagogy or
- 28 workshop\$ or online or virtual or quiz or video).mp. (1328890)
- 29 21 pedagogic\$.mp. (8113)
- 30 22 or/19-21 (1331790)
- 31 23 18 and 22 (970)
- 32 24 academic achievement/ or professional competence/ or clinical competence/ or self-
- 33 evaluation/ (153355)
- 34 25 (outcome\$ or effective\$ or confidence or confident or knowledge or success\$ or fail\$ or fear
- 35 or thanatophobi\$).mp. (8513098)
- 36 26 palliative care scale.mp. (20)
- 37 27 best practice.mp. (21427)
- 38 28 competen\$.mp. (242000)
- 39 29 (measure\$ or assess\$).mp. (8024940)
- 40 30 or/24-29 (13437333)
- 41 31 23 and 30 (723)





# PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4 (table 1)
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	5



# PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	6
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	6 (table 2)
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	6
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	8
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	9
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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