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Effectiveness of Structured Oncology Nursing Education Interventions: A Systematic Review of Educational Strategies and Competency Outcomes

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Systematic Review

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Highlights:

- Structured oncology education is consistently associated with improvements in nurses' knowledge and competency-related outcomes.
- Simulation, blended learning and active strategies show stronger gains in applied skills and professional confidence.
- Embedding oncology-specific competencies within structured curricula supports preparedness for complex cancer care.

Abstract

Background: As cancer care becomes increasingly complex, nurses require advanced clinical, communicative and psychosocial competencies. Structured oncology education has been developed across undergraduate and continuing professional development contexts; however, the educational effectiveness and pedagogical characteristics of these interventions remain insufficiently synthesised. This review evaluates the effectiveness of structured oncology nursing education strategies in developing competency-related outcomes and examines their implications for curriculum design.

Methods: A systematic review was conducted in accordance with PRISMA 2020 guidelines. PubMed, CINAHL, Scopus, Web of Science and Cochrane Library were searched through December 2025. Interventional studies evaluating structured oncology education programmes for nurses or nursing students were included. Risk of bias was assessed using RoB 2, ROBINS-I and JBI appraisal tools. Given heterogeneity in design and outcome measurement, findings were synthesised narratively.

Results: Fourteen studies representing diverse global contexts evaluated workshops, simulation-based learning, blended and distance education, outcome-based curricula and in-service training. Across designs, structured oncology education was consistently associated with improvements in knowledge, self-efficacy and selected domains of clinical and communication competence. Interventions incorporating simulation, active learning and blended modalities demonstrated stronger gains in skills-based and confidence outcomes. Methodological limitations included small samples, reliance on self-reported measures and limited long-term follow-up.

Conclusion: Structured oncology nursing education interventions are associated with improvements in cognitive, psychomotor and affective competency domains. Findings support the integration of competency-based, practice-aligned oncology content into undergraduate curricula and continuing professional development frameworks. Future research should prioritise rigorous designs, validated performance measures and longitudinal evaluation to strengthen the evidence base for oncology nursing education.

Keywords: Oncology nursing education; Nursing competence; Systematic review; Professional development; Blended learning; Palliative care; Evidence based practice

1 Introduction

Oncology nursing has become an increasingly important specialty as global cancer incidence continues to rise and treatment pathways grow more complex. Cancer accounts for millions of new cases and deaths worldwide each year and this burden is projected to increase with population ageing, lifestyle changes and environmental exposures (Filho et al., 2025). Advances in diagnostics, systemic therapies, radiotherapy and palliative care have expanded treatment options, but they have also increased the complexity of care delivery. Nurses are central to this continuum, supporting patients and families from diagnosis through active treatment, survivorship and end-of-life care. In many settings, oncology nurses administer chemotherapy, monitor toxicities, manage symptoms, provide psychosocial and spiritual support and coordinate multidisciplinary plans of care (Hu et al., 2019; Moosavi et al., 2019).

These responsibilities require more than foundational clinical knowledge. Oncology nurses must demonstrate advanced clinical reasoning, therapeutic communication, ethical decision-making and cultural sensitivity to safely manage high-risk treatments and respond to patients' multifaceted needs (Shin et al., 2015). Professional competence in oncology nursing is commonly conceptualised as an integrated combination of knowledge, psychomotor skills, attitudes and clinical judgement necessary to deliver safe, person-centred care. Competence is particularly critical in oncology because treatment protocols evolve rapidly and medication errors may have life-threatening consequences (Abd-Elrahman Radwan et al., 2022; Coyne et al., 2019). Strengthening oncology nursing competence is therefore both a clinical and educational priority.

Structured oncology education programmes, delivered through undergraduate curricula, postgraduate qualifications, continuing professional development (CPD) and in-service training, aim to support this competency development. Such programmes typically address cancer biology, treatment modalities, symptom management and palliative care, while also enhancing communication and psychosocial skills (Fan et al., 2015). A well-aligned curriculum can help bridge the gap between theoretical knowledge and clinical application, promote safe chemotherapy administration and improve preparedness for complex care situations. At an organisational level, a competent oncology nursing workforce has been associated with improved adherence to evidence-based practice and safer medication management (Petersen et al., 2017).

Despite these efforts, oncology nursing education remains variable across contexts. Professional bodies such as the Oncology Nursing Society (ONS) and European Oncology Nursing Society (EONS) advocate structured curricula and defined competency frameworks (EONS, 2022); Oncology-Nursing-Society (2024), yet implementation is inconsistent. In many pre-registration programmes, oncology content is dispersed across broader medical-surgical modules and CPD opportunities may be irregular or insufficiently evaluated. Nurses may consequently report feeling underprepared for chemotherapy administration, symptom management or end-of-life communication (Kutluturkan et al., 2016). These disparities are often more pronounced in low- and middle-income countries, where specialist training infrastructure is limited (Karim et al., 2021; Kim et al., 2020), although even high-income settings face challenges related to workload and access to accredited oncology qualifications (Bryant-Lukosius et al., 2016).

Emerging educational strategies, including simulation-based learning, blended and distance education, case-based discussion and reflective workshops, seek to strengthen both applied skills and professional confidence (Hockenberry et al., 2020; Taj et al., 2022; Usman et al., 2025).The development of oncology nursing competence can be interpreted through established educational frameworks. Competency-Based Education (CBE) emphasises clearly defined learning outcomes and alignment between instruction and assessment. Miller's Pyramid of Clinical Competence conceptualises progression from knowledge ("knows") to demonstrated performance ("shows how" and "does"), underscoring the importance of practice-aligned educational strategies. Additionally, Bandura's Self-Efficacy Theory provides a lens for understanding confidence-related outcomes frequently reported in oncology education studies, as mastery experiences and feedback may enhance perceived capability to manage complex care situations.

However, the literature evaluating oncology education interventions is heterogeneous in design, content focus and outcome measurement. Many studies employ small samples, non-randomised designs and short-term, self-reported outcomes (Snyder, 2019), limiting clarity regarding which educational strategies most effectively support competency development.

Accordingly, this systematic review critically synthesises interventional evidence on structured oncology education programmes for nurses and nursing students. *The objective is to evaluate their effectiveness in developing competency-related*

outcomes, including knowledge, clinical skills and self-efficacy and to consider implications for curriculum design in oncology nursing education.

2 Methodology

2.1 Design and reporting

This systematic review examined the effectiveness of structured oncology nursing education interventions in developing competency-related outcomes among nurses and nursing students. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The protocol was registered in the International Prospective Register of Systematic Reviews (*PROSPERO; registration number CRD420261298185*).

The review question and eligibility criteria were structured using the Population:Intervention:Comparator:Outcome (PICO) framework.

2.2 Eligibility criteria

Population: Registered nurses and nursing students involved in oncology care or oncology-related education were eligible.

Interventions: Structured oncology education interventions were included. These comprised undergraduate modules, postgraduate courses, workshops, short courses, simulation-based training, blended or distance learning programmes, in-service training and continuing professional development (CPD) initiatives with clearly described oncology, palliative care, cancer screening, or psychosocial oncology content.

Comparators: Eligible comparators included usual education, no intervention, alternative educational approaches, or baseline measurements in single-group pre–post designs.

Outcomes: Studies were required to report quantitative outcomes related to competency development, including knowledge, clinical skills, observed competence, self-efficacy, confidence, communication competence, or psychosocial care capability.

Study design: Empirical interventional studies were included, specifically:

- Randomised controlled trials (RCTs)
- Quasi-experimental studies (with or without comparison groups)
- Pre–post interventional designs

Studies were included if they were peer-reviewed articles published in English between January 2010 and December 2025.

The following were excluded: conference abstracts, dissertations, editorials, protocols, purely descriptive or cross-sectional studies without an intervention, studies involving only non-nursing professionals or caregivers and studies lacking extractable quantitative outcome data.

2.3 Information sources and search strategy

A comprehensive electronic search was conducted in PubMed (MEDLINE), CINAHL, Scopus, Web of Science Core Collection and the Cochrane Library from database inception to December 2025. Search strategies combined controlled vocabulary terms and free-text keywords related to oncology nursing and education (e.g., “oncology nursing,” “cancer nursing,” “education,” “training,” “competence,” “self-efficacy,” “clinical skills”), using Boolean operators and truncation as appropriate. Search syntax was adapted for each database.

Reference lists of included studies and relevant reviews were manually screened to identify additional eligible studies.

2.4 Study selection

All records were imported into reference management software for duplicate removal and then transferred to a screening platform. Two reviewers independently screened titles and abstracts against the predefined eligibility criteria. Full-text articles were retrieved for potentially relevant studies and independently assessed by the same reviewers.

Disagreements at any stage were resolved through discussion and, where necessary, consultation with a third reviewer. Reasons for exclusion at the full-text stage were documented. The study selection process is presented in a PRISMA 2020 flow diagram.

2.5 Data extraction

A standardised data extraction form was developed and pilot-tested. The following data were extracted for each study:

- Author(s), year and country
- Study design and setting
- Participant characteristics and sample size

- Description of the educational intervention (content, format, duration, delivery mode)
- Comparator (if applicable)
- Outcome measures (instrument type, timing of assessment)
- Key quantitative findings

Two reviewers independently extracted data and cross-checked entries for accuracy. Discrepancies were resolved through discussion. Where reporting was unclear, attempts were made to contact study authors for clarification. All reported results compatible with the predefined outcome domains were extracted. Where multiple time points were reported, immediate post-intervention outcomes were prioritised. No assumptions were made regarding missing statistical data beyond those explicitly reported by study authors.

2.6 Quality appraisal and risk of bias

Methodological quality and risk of bias were assessed independently by two reviewers using design-appropriate appraisal tools:

- Randomised controlled trials were evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool.
- Non-randomised studies with comparison groups were assessed using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I).
- Single-group pre–post studies were appraised using relevant Joanna Briggs Institute (JBI) critical appraisal checklists.

Risk-of-bias judgments were recorded at study level and, where applicable, by domain. Disagreements were resolved through discussion. Consistent with the nature of educational research, challenges related to blinding and reliance on self-reported outcomes were anticipated. Quality appraisal findings were used to inform interpretation of results but were not used as criteria for study exclusion.

2.7 Data synthesis

Given substantial heterogeneity in study design, participant populations, intervention characteristics, and outcome measurement tools, a narrative synthesis approach was undertaken. Studies were organised according to educational strategy (e.g., simulation-based, blended learning, workshop-based, in-service training, outcome-based curriculum) and outcome domain (knowledge, clinical skills or competence, self-efficacy or confidence, and communication or psychosocial competence).

The synthesis focused on identifying patterns in the direction, consistency, and relative strength of reported effects across studies, while considering methodological quality and risk-of-bias assessments. Particular attention was given to the use of active learning strategies, competency-based curriculum alignment, and performance-based assessment methods, given their relevance to competency development frameworks. Quantitative meta-analysis was not performed due to heterogeneity in study designs, intervention formats, and outcome measures, which precluded meaningful statistical pooling. For similar reasons, formal assessment of reporting bias and certainty of evidence (e.g., GRADE) was not undertaken.

3 Results

3.1 Study selection

The electronic database searches and supplementary reference screening yielded 1705 records. After removal of duplicates, 1052 titles and abstracts were screened. Of these, 176 full-text articles were assessed for eligibility. Following full-text review against the predefined inclusion criteria, 14 studies were included in the final synthesis (Figure 1).

Studies were excluded at full-text stage for the following reasons: absence of a clearly defined oncology education intervention, inclusion of non-nursing populations only, descriptive or cross-sectional design without an intervention component and lack of extractable quantitative outcome data.

The 14 included studies were conducted between 2014 and 2024 across diverse geographical contexts, including Japan, Taiwan, Iraq, India, Malawi, multiple East African countries, the United States, Germany, Egypt and Iran. The selection process is summarised in the PRISMA 2020 flow diagram (Figure 1).

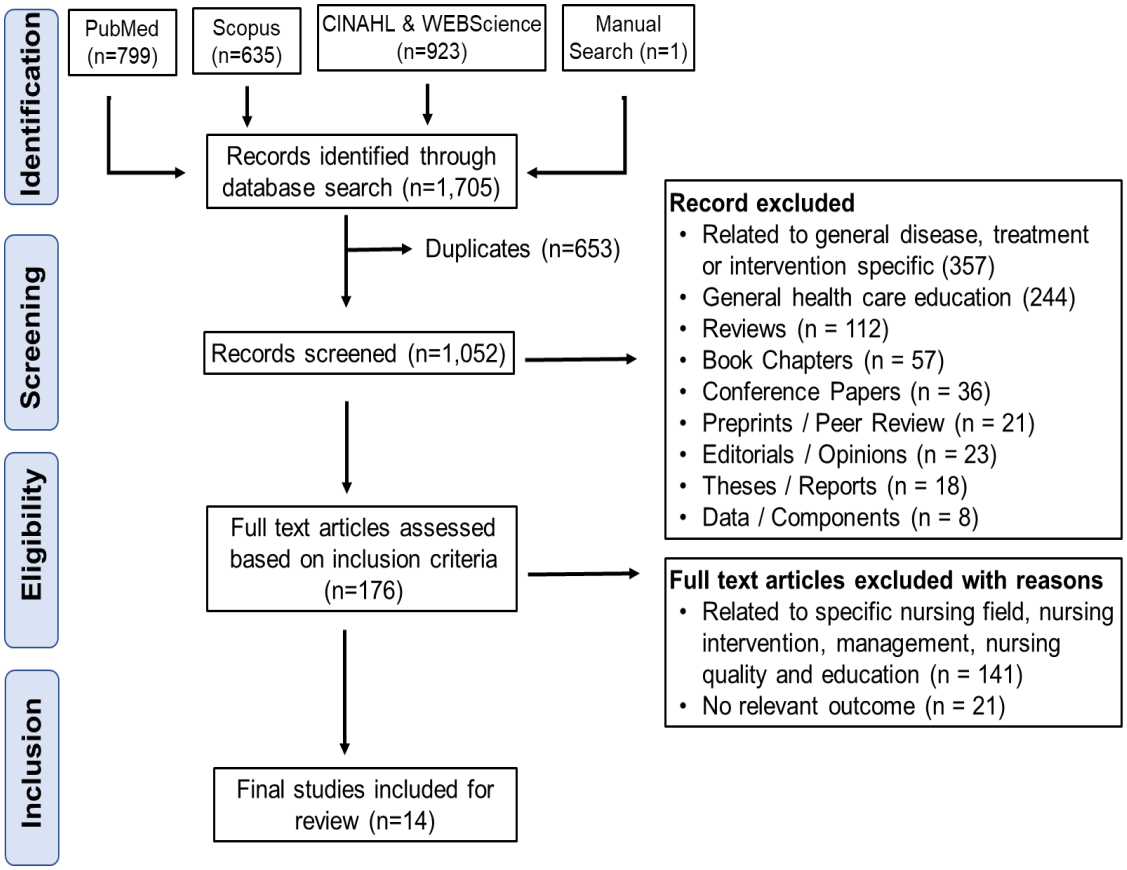


Figure 1. PRISMA 2020 flow diagram of study selection.

3.2 Characteristics of included studies

The included studies represented a heterogeneous body of evidence in terms of educational design, participant population and outcome measurement. Participants included registered oncology nurses (including chemotherapy and palliative care nurses), paediatric oncology nurses, certified palliative care nurses, undergraduate nursing students and, in one study, interprofessional groups of nurses and pharmacists. Sample sizes ranged from 52 participants in a pilot randomised controlled trial (Johannsen et al., 2023) to 210 nurses in a virtual continuing education programme (Hotchkiss et al., 2023).

Five studies employed randomised controlled designs (Aebersold et al., 2021; Hsu et al., 2019; Johannsen et al., 2023; Morita et al., 2014; Nagamatsu et al., 2014a). Two quasi-experimental studies included comparison groups (Shahmohammadi et al., 2024; Taj et al., 2022), while the remaining studies used single-group pre–post designs (Dhanasekaran et al., 2022; Hockenberry et al., 2020; Hotchkiss et al., 2023; Mohammed & Aburaghif, 2018; Mohammed et al., 2023; Nagamatsu et al., 2014b).

Overall, quasi-experimental and pre–post approaches predominated, reflecting common evaluation methods in educational research.

Interventions varied widely in scope and format, ranging from short workshops focused on specific competency domains, such as mesothelioma care, advance care planning, or psychosocial support, to broader curriculum-based initiatives, including outcome-based undergraduate modules, blended learning programmes, simulation-based chemotherapy safety training and in-service skills development. Several studies incorporated active learning strategies, including simulation and case-based discussion, whereas others relied primarily on structured didactic instruction.

Outcomes were categorised into four domains: knowledge acquisition, clinical skills or observed competence, self-efficacy or professional confidence and communication or psychosocial competence. Knowledge and confidence outcomes were most frequently reported, while objective performance assessments and longer term follow up were comparatively limited. Detailed study characteristics are presented in Table 1.

No.	Author (Year)	Country	Design	Participants (N, population)	Educational strategy	Intervention focus	Outcomes assessed	Comparator
1	Nagamatsu et al. (2014a)	Japan	RCT	177 nurses (mesothelioma care)	Workshop-based	Palliative care education + handbook	Knowledge; attitudes; perceived difficulty	No intervention
2	Nagamatsu et al. (2014b)	Japan	Pre–post	27 oncology/palliative nurses	Workshop-based	Mesothelioma-focused education	Knowledge; attitudes; difficulty scores	Baseline
3	Morita et al. (2014)	Japan	RCT	121 nurses (terminal cancer care)	Workshop-based	Psychosocial / meaning-centred training	Confidence; understanding of existential distress	Routine practice
4	Mohammed & Aburaghif (2018)	Iraq	Pre–post	70 paediatric oncology nurses	In-service training	Chemotherapy side-effects education	Knowledge	Baseline
5	Hsu et al. (2019)	Taiwan	RCT	150 undergraduate nursing students	Curriculum-based (CBE)	Outcome-based oncology module	Knowledge; competence; self-confidence	Lecture-based teaching
6	Hockenberry et al. (2020)	Malawi, Uganda, Botswana	Pre–post	94 paediatric oncology nurses	Distance-based education	Global HOPE paediatric oncology training	Knowledge	Baseline
7	Aebersold et al. (2021)	USA	RCT	85 oncology nurses and pharmacists	Simulation + interprofessional	Chemotherapy safety training	Knowledge; competence; confidence	Usual education
8	Taj et al. (2022)	East Africa	Quasi-experimental	120 oncology nurses	Blended learning	Oncology nursing skills training	Knowledge; skills; self-efficacy	Comparison group
9	Dhanasekaran et al. (2022)	India	Pre–post	91 nursing students	Workshop-based	Cancer screening education	Screening knowledge; awareness	Baseline
10	Johannsen et al. (2023)	Germany	Pilot RCT	52 nurses/HCPs	Communication skills training	Psychoeducational intervention (parental cancer)	Knowledge; communication confidence; self-efficacy	Delayed/no training

No.	Author (Year)	Country	Design	Participants (N, population)	Educational strategy	Intervention focus	Outcomes assessed	Comparator
11	Yahiro et al. (2023)	Japan	Pre–post	60 palliative care nurses	Communication training	Advance Care Planning training	Communication competence; confidence	Baseline
12	Hotchkiss et al. (2023)	Malawi	Pre–post	210 oncology nurses	Distance-based / virtual CPD	Continuing oncology education	Knowledge (quiz scores)	Baseline
13	Mohammed H. et al. (2023)	Egypt	Pre–post	70 chemotherapy nurses	In-service training	Extravasation prevention	Knowledge; procedural skills	Baseline
14	Shahmohammadi et al. (2024)	Iran	Quasi-experimental	80 oncology nurses	Workshop-based	Aesthetic end-of-life care training	Attitudes; perceptions	Non-trained comparison

Table 1. Characteristics of included oncology education studies (n = 14).

3.3 Critical appraisal and risk of bias

A summary of methodological quality and risk-of-bias assessments is presented in Table 2, with domain-level judgments for randomised controlled trials illustrated in Figure 2. Overall, methodological quality ranged from low risk to moderate concerns across the included studies.

Randomised controlled trials, appraised using the Cochrane Risk of Bias 2 tool, were generally judged as either low risk or as having some concerns. The most commonly identified issues were incomplete reporting of random sequence generation and allocation concealment, limited blinding of participants and outcome assessors and reliance on self-reported outcome measures. As shown in Figure 2, most trials were rated as having some concerns across one or more domains.

Quasi-experimental and single-group pre–post studies, assessed using ROBINS-I or Joanna Briggs Institute (JBI) appraisal tools, were predominantly rated as having moderate risk of bias. The principal sources of bias included absence of random allocation, lack of control groups, convenience sampling and short-term outcome assessment. Several studies relied on immediate post-intervention testing without extended follow-up.

Across study designs, additional methodological limitations included limited reporting of instrument validity, particularly for locally developed knowledge or attitudinal scales, and infrequent use of objective or blinded performance-based assessments.

No.	Author (Year)	Design	Appraisal Tool	Overall Judgment	Key Methodological Limitations
1	Nagamatsu et al. (2014a)	RCT	RoB 2	Some concerns	Unclear allocation concealment; limited blinding; immediate post-test outcomes; reliance on self-report.
2	Nagamatsu et al. (2014b)	Pre–post	JBI	Moderate	Single-group design; no control; short-term follow-up; self-reported outcomes.
3	Morita et al. (2014)	RCT	RoB 2	Some concerns	Limited reporting of randomisation; self-reported measures; no long-term follow-up.
4	Mohammed & Aburaghif (2018)	Pre–post	JBI	Moderate	No control group; convenience sampling; immediate post-test; self-report outcomes.
5	Hsu et al. (2019)	RCT	RoB 2	Some concerns	No blinding; possible contamination; self-reported competence and confidence.
6	Hockenberry et al. (2020)	Pre–post	JBI	Moderate	No control; potential selection bias; short-term outcomes; implementation variability.
7	Aebersold et al. (2021)	RCT	RoB 2	Some concerns	Incomplete reporting of randomisation; blinding not feasible; partly self-reported outcomes; modest sample size.
8	Taj et al. (2022)	Quasi-experimental	ROBINS-I	Moderate	Non-random allocation; potential confounding; limited reporting of attrition; no blinded assessment.
9	Dhanasekaran et al. (2022)	Pre–post	JBI	Moderate	Single-group design; self-reported knowledge; limited psychometric reporting; no long-term follow-up.
10	Johannsen et al. (2023)	RCT (pilot)	RoB 2	Some concerns	Small sample; limited statistical power; no blinding; partly self-reported outcomes.
11	Yahiro et al. (2023)	Pre–post	JBI	Moderate	No control group; self-reported communication outcomes; short follow-up.
12	Hotchkiss et al. (2023)	Pre–post	JBI	Moderate	No control group; quiz-based knowledge measure only; possible response bias.
13	Mohammed H. et al. (2023)	Pre–post	JBI	Moderate	Non-randomised single-group design; convenience sampling; no blinded skills assessment.
14	Shahmohammadi et al. (2024)	Quasi-experimental	ROBINS-I	Moderate	Non-random allocation; potential baseline imbalance; primarily attitudinal outcomes; limited follow-up.

Table 2. Risk of bias and methodological quality of included studies.

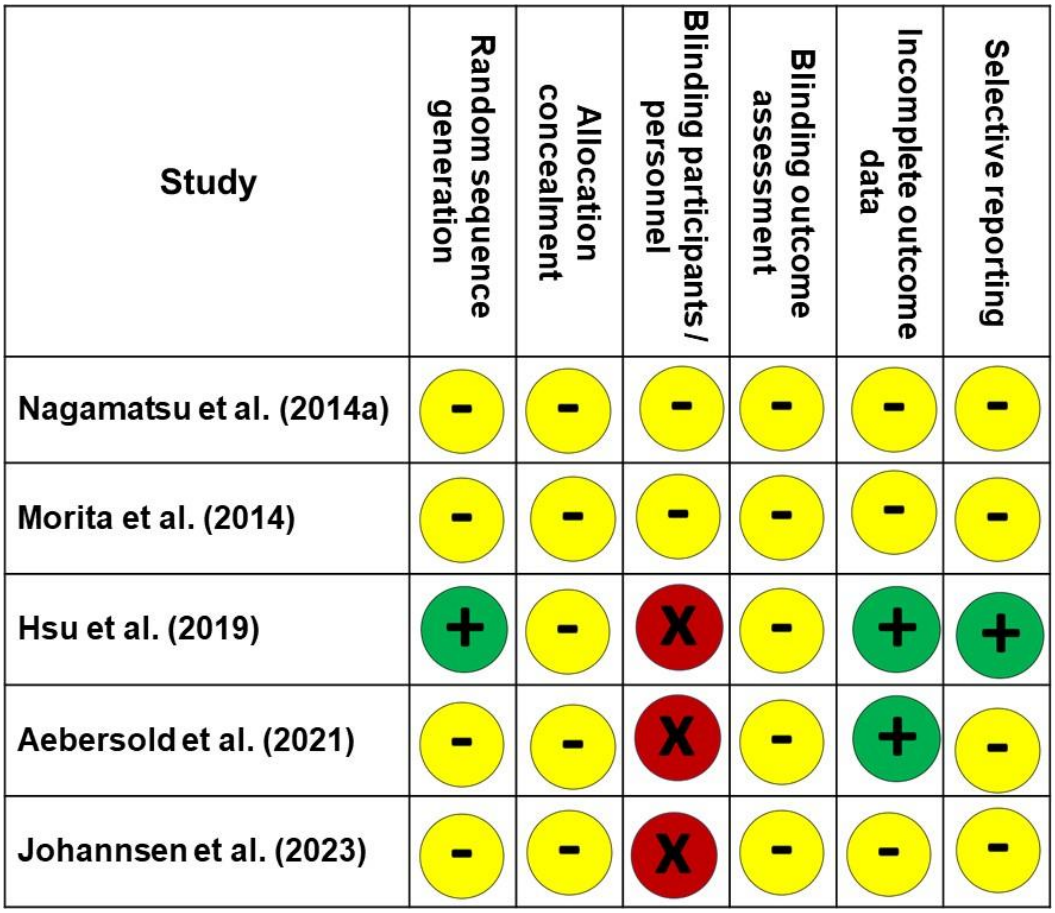


Figure 2. Risk-of-bias assessment across RoB 2 domains for randomised controlled trials. Traffic-light plot summarising risk-of-bias judgments for included randomised controlled trials across the following domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data and selective reporting. Green indicates low risk of bias, yellow indicates some concerns and red indicates high risk of bias. Most trials were rated as having some concerns, primarily due to limited reporting of allocation procedures and lack of blinding inherent to educational interventions.

3.4 Effects of oncology education programmes on knowledge

Knowledge was the most frequently assessed outcome across included studies. All studies reporting knowledge measures described post-intervention improvements following structured oncology education.

Randomised controlled trials in Japan evaluating mesothelioma and palliative care education reported significantly higher post-test knowledge scores in intervention groups compared with usual education (Nagamatsu et al., 2014b; Nagamatsu et al.,

2014a). Similarly, an RCT of an outcome-based undergraduate oncology module in Taiwan demonstrated higher post-intervention oncology knowledge scores compared with traditional lecture-based teaching (Hsu et al., 2019).

In lower-resource contexts, distance and blended education programmes were associated with improvements in knowledge scores. The Global HOPE paediatric oncology distance programme reported significant gains among nurses in Malawi, Uganda and Botswana (Hockenberry et al., 2020), while a virtual continuing education series in Malawi demonstrated increases in quiz performance across more than 200 nurses (Hotchkiss et al., 2023). Quasi-experimental in-service programmes in Iraq and Egypt also reported significant improvements in chemotherapy-related knowledge and extravasation management knowledge following targeted teaching (Mohammed & Aburaghif, 2018; Mohammed et al., 2023).

Although improvements were consistently reported, knowledge was typically assessed immediately post-intervention and instrument validation was variably described.

3.5 Effects on clinical competence and practical skills

Clinical competence and practical skills were less frequently assessed than knowledge outcomes. Where structured performance measures were used, improvements were reported following educational interventions.

Interprofessional simulation and online chemotherapy safety training in the United States demonstrated improvements in observed competence related to cancer drug therapy handling (Aebersold et al., 2021). In-service training on chemotherapy extravasation prevention in Egypt was associated with improvements in both knowledge and observed procedural performance (Mohammed et al., 2023). Blended oncology training in East Africa reported gains in self-rated and supervisor-reported clinical skills (Taj et al., 2022).

However, objective or blinded performance-based assessments were used in a minority of studies. Most competence-related outcomes were either self-rated or assessed immediately following training.

3.6 Effects on self-efficacy and professional confidence

Self-efficacy and professional confidence were commonly reported secondary outcomes. Across undergraduate and continuing education contexts, participants frequently reported increased confidence following oncology education interventions. Students exposed to an outcome-based oncology module reported higher self-confidence in clinical application compared with students receiving conventional teaching (Hsu et al., 2019). Blended and distance education initiatives in East Africa and Malawi were associated with increases in perceived clinical competence and self-efficacy (Hockenberry et al., 2020; Hotchkiss et al., 2023; Taj et al., 2022). Interprofessional chemotherapy safety training reported improved confidence in managing medication-related risks (Aebersold et al., 2021). Psychoeducational and advance care planning workshops similarly reported increases in confidence related to complex communication tasks (Johannsen et al., 2023; Yahiro et al., 2023).

In studies reporting both knowledge and self-efficacy, increases in confidence were observed alongside improvements in knowledge or skills. Most self-efficacy measures were self-reported and assessed immediately post-intervention.

3.7 Effects on communication, psychosocial and spiritual care

Several studies specifically evaluated communication and psychosocial competency domains. A randomised controlled trial in Japan examining a workshop addressing meaning-centred care reported improvements in nurses' confidence and understanding of patients' existential distress compared with routine practice (Morita et al., 2014). Advance care planning training for certified palliative care nurses was associated with enhanced communication competence and confidence (Yahiro et al., 2023).

A pilot randomised controlled trial in Germany evaluating psychoeducational training for healthcare professionals supporting parents with cancer reported increased communication confidence and self-efficacy among intervention participants (Johannsen et al., 2023). In Iran, aesthetic care training for end-of-life cancer care was associated with improvements in nurses' attitudes and perceptions toward holistic end-of-life practice (Shahmohammadi et al., 2024).

Across communication-focused interventions, outcomes were predominantly measured using self-report scales and follow-up periods were generally short.

No.	Author (Year)	Knowledge	Clinical competenc / skills	Self-efficacy / confidence	Communication / psychosocial outcomes	Overall findings
1	Nagamatsu et al. (2014a)	Improved	Not assessed	Reduced perceived difficulty	Not assessed	Improved knowledge and perceived care difficulty
2	Nagamatsu et al. (2014b)	Improved	Not assessed	Attitudes improved	Not assessed	Improved knowledge and attitudes
3	Morita et al. (2014)	Not assessed	Not assessed	Improved confidence	Improved understanding of existential distress	Improved psychosocial competence
4	Mohammed & Aburaghif (2018)	Improved	Not assessed	Not assessed	Not assessed	Improved chemotherapy knowledge
5	Hsu et al. (2019)	Improved	Improved	Improved	Not assessed	Enhanced oncology readiness
6	Hockenberry et al. (2020)	Improved	Not assessed	Improved	Not assessed	Improved paediatric oncology knowledge
7	Aebersold et al. (2021)	Improved	Improved	Improved	Improved collaboration skills	Enhanced chemotherapy safety practice
8	Taj et al. (2022)	Improved	Improved	Improved	Not assessed	Strengthened knowledge and skills
9	Dhanasekaran et al. (2022)	Improved	Not assessed	Improved preparedness	Not assessed	Improved screening readiness
10	Johannsen et al. (2023)	Improved	Not assessed	Improved	Improved communication competence	Enhanced psycho-oncology communication
11	Yahiro et al. (2023)	Not assessed	Not assessed	Improved	Improved ACP communication	Improved advance care planning competence
12	Hotchkiss et al. (2023)	Improved	Not assessed	Improved	Not assessed	Improved oncology knowledge at scale
13	Mohammed H. et al. (2023)	Improved	Improved	Improved	Not assessed	Improved chemotherapy procedural competence
14	Shahmohammadi et al. (2024)	Not assessed	Not assessed	Improved	Improved EOL care attitudes	Improved humanistic end-of-life attitudes

Table 3. Summary of reported outcomes across competency domains.

4 Discussion

This systematic review synthesised evidence from 14 interventional studies evaluating structured oncology education programmes for nurses and nursing students across diverse international contexts. Overall, the findings indicate that structured oncology education is consistently associated with improvements in knowledge and is frequently linked to gains in clinical competence, self-efficacy and selected communication or psychosocial outcomes (Aebersold et al., 2021; Hsu et al., 2019; Morita et al., 2014; Taj et al., 2022). Although methodological quality varied, the consistency in direction of findings suggests that explicit, curriculum-aligned oncology education contributes meaningfully to competency development in cancer care.

4.1 Oncology knowledge, competence and self-efficacy

Knowledge acquisition was the most consistently reported outcome across studies. Improvements were observed across workshop-based, curriculum-based, simulation-supported and distance learning interventions (Hockenberry et al., 2020; Hsu et al., 2019; Mohammed et al., 2023). These findings align with foundational stages of competence described in Miller's framework, in which learners progress from "knows" to "knows how." Structured and outcome-based curricula, such as the undergraduate module evaluated by Hsu et al. (2019), reflect principles of Competency-Based Education (CBE), emphasising alignment between learning objectives, instruction and assessment (Fan et al., 2015).

Evidence regarding clinical competence and applied skills was less extensive but encouraging. Studies incorporating simulation, structured checklists or observed performance measures reported improvements in chemotherapy safety practices and procedural skills (Aebersold et al., 2021; Mohammed et al., 2023). These findings are consistent with broader nursing education literature demonstrating that simulation and practice-based learning enhance procedural competence and support safe clinical performance (Silva et al., 2022; Usman et al., 2025). However, relatively few studies evaluated progression to observable workplace performance or included longer-term follow-up, limiting conclusions regarding durability of skill acquisition (Coyne et al., 2019; Snyder, 2019).

Self-efficacy and professional confidence were frequently reported secondary outcomes. Improvements in perceived competence were observed across undergraduate, blended and communication-focused interventions (Hsu et al., 2019;

Johannsen et al., 2023; Yahiro et al., 2023). From the perspective of Bandura's self-efficacy theory, structured learning experiences that provide mastery opportunities and feedback may enhance perceived capability to manage complex oncology care situations. Similar associations between education and confidence have been reported in oncology and palliative care settings (Howell et al., 2023; Sharour, 2019). Nonetheless, most measures were self-reported and assessed immediately following intervention.

4.2 Communication, psychosocial and spiritual care

Several interventions addressed communication and psychosocial competencies, particularly within palliative and end-of-life contexts. Workshops focused on meaning-centred care, advance care planning and psychoeducational communication were associated with improvements in reported communication confidence and psychosocial understanding (Johannsen et al., 2023; Morita et al., 2014; Yahiro et al., 2023). These findings are consistent with prior evidence demonstrating that structured communication skills training enhances empathy, patient-centred dialogue and comfort with end-of-life discussions among oncology professionals (Banerjee et al., 2017; Barth & Lannen, 2011).

Relational competence is central to holistic oncology nursing practice (Hu et al., 2019; Moosavi et al., 2019). Educational approaches incorporating reflective discussion, case-based learning and guided practice may support development of these competencies. However, validated communication assessment tools and longitudinal behavioural evaluation were limited across included studies. Future research should prioritise rigorous measurement of communication performance and sustained impact on patient and family experience.

4.3 Implications for education, practice and policy

The findings support integration of structured oncology education within competency-based curricular frameworks at both undergraduate and continuing professional development levels. International frameworks, including those from the European Oncology Nursing Society (EONS) and the Oncology Nursing Society (ONS), emphasise defined oncology competencies and progressive levels of practice (EONS, 2022; Oncology-Nursing-Society, 2024). The present review reinforces the importance of aligning oncology-specific learning objectives with instructional strategies and assessment approaches, consistent with CBE principles (Fan et al., 2015).

Simulation, blended learning and structured workshops appear particularly aligned with competency development, especially in high-risk domains such as chemotherapy safety. Distance-based and blended education initiatives demonstrated effectiveness across low- and middle-income contexts (Hockenberry et al., 2020; Taj et al., 2022), supporting scalability where specialist educators are limited. Broader oncology education initiatives similarly highlight the potential of digital and blended models to strengthen workforce capacity (Karim et al., 2021; Semerci et al., 2024).

At a policy level, establishing minimum oncology education standards and ensuring protected time for oncology-focused continuing education may strengthen practice consistency and patient safety (Kutluturkan et al., 2016; Petersen et al., 2017).

4.4 Strengths, limitations and future research

This review employed comprehensive database searching, explicit eligibility criteria, PRISMA 2020 reporting and structured risk-of-bias appraisal using validated tools (Aromataris et al., 2015; Page et al., 2021). Inclusion of studies across diverse global contexts enhances relevance for international oncology nursing education.

However, heterogeneity in intervention formats, outcome measures and study design limited direct comparison across studies. The predominance of quasi-experimental and pre–post designs, reliance on self-reported outcomes and limited long-term follow-up constrain certainty regarding sustained behavioural impact. Restriction to English-language publications may also have introduced selection bias.

Future research should prioritise rigorous comparative designs, use of validated and performance-based assessment tools and longitudinal evaluation of knowledge retention and behavioural transfer. Linking educational outcomes to clinical indicators, such as medication safety or patient-reported outcomes, would strengthen the evidence base for oncology nursing education.

5 Conclusion

This review demonstrates that structured oncology education programmes are associated with consistent improvements in oncology-related knowledge and are frequently linked to gains in clinical competence, self-efficacy and communication skills among nurses and nursing students. Educational strategies incorporating active learning approaches—such as simulation, workshops and blended learning—appear particularly aligned with competency development. However, the predominance of

quasi-experimental designs, reliance on self-reported measures and limited long-term follow-up temper certainty regarding sustained behavioural impact.

Embedding oncology-specific competencies within structured, competency-based curricula and continuing professional development frameworks may strengthen workforce preparedness for complex cancer care. Future research should prioritise rigorous evaluation designs and performance-based assessment to advance the evidence base for oncology nursing education.

6 Declarations

6.1 Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

6.2 Competing interests

The authors declare that they have no competing interests.

6.3 Funding

This research received no specific grant from any funding agency in the public, commercial or not for profit sectors.

6.4 Authors' contributions

Faizah Jabr Alsulami: Conceptualization, Data curation, Formal analysis, Writing original draft. Regidor III Dioso: Supervision, Validation, Writing, review & editing.

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6.6 Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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