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ADMINISTRATIVE INFORMATION**Support - None.****Review Stage at time of this submission -** The authors declare no conflicts of interest.**Conflicts of interest -** None declared.**INPLASY registration number:** INPLASY2025100074**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 21 October 2025 and was last updated on 21 October 2025.**INTRODUCTION**

Review question / Objective To systematically evaluate the effectiveness of integrated multidisciplinary team (MDT)-based learning strategies compared to conventional pedagogical approaches on professional competency outcomes in radiation oncology education, and to conduct a meta-analysis to provide evidence-based guidance for curriculum development and implementation in radiation oncology training programs.

Rationale

Radiation oncology represents a highly specialized medical discipline requiring mastery of complex physics concepts, radiobiology principles, and clinical decision-making skills across rapidly evolving technological landscapes. Traditional lecture-based teaching in radiation oncology faces substantial limitations, particularly in engaging learners in active problem-solving and preparing trainees for real-world multidisciplinary tumor

board discussions. While previous studies have examined problem-based learning (PBL) and case-based learning (CBL) effectiveness in general medical education, no comprehensive synthesis has evaluated these approaches specifically in radiation oncology education. Given the unique technical and interdisciplinary demands of radiation oncology training, specialty-specific evidence is essential for guiding curriculum development.

Condition being studied

Educational effectiveness in radiation oncology training, specifically comparing multidisciplinary team-based learning approaches (including MDT combined with problem-based learning and case-based learning) versus traditional lecture-based teaching methods. The study focuses on professional competency outcomes including theoretical knowledge acquisition, operational skills development, case analysis abilities, and student satisfaction in radiation oncology education.

METHODS

Search strategy

Databases: PubMed, Web of Science, Education Resources Information Center (ERIC), Chinese National Knowledge Infrastructure (CNKI), Weipu database, and Wanfang database.

Terms: ((Topic: "Radiation Oncology" OR "Radiotherapy" OR "Radiation Medicine") AND (Topic: "Multidisciplinary Team" OR "MDT") AND (Topic: "Problem-Based Learning" OR "PBL" OR "Case-Based Learning" OR "CBL") AND (Topic: "Medical Education" OR "Clinical Teaching" OR "Residency Training")). Additional studies will be identified through manual searching of reference lists.

Participant or population

Radiation oncology students, residents, fellows, interns, and medical students participating in radiation oncology education programs.

Intervention

Multidisciplinary team (MDT)-based teaching approaches including: MDT combined with problem-based learning (MDT+PBL), MDT combined with case-based learning (MDT+CBL), or integrated MDT with both PBL and CBL (MDT+PBL+CBL).

Comparator

Traditional lecture-based learning (LBL) or conventional pedagogical approaches.

Study designs to be included

Randomized controlled trials and cohort studies.

Eligibility criteria

Inclusion Criteria:

1. Study design: Randomized controlled trials, cohort studies;
2. Population: Radiation oncology residents, fellows, interns, medical students;
3. Intervention: MDT-based teaching (MDT, MDT+PBL, MDT+CBL, MDT+PBL+CBL);
4. Comparator: Traditional lecture-based learning (LBL);
5. Outcomes: Examination scores, satisfaction rates;
6. Language: English, Chinese;
7. Publication: Peer-reviewed journals with full text available.

Exclusion Criteria:

1. Case reports, reviews, meta-analyses;
2. Nursing students, non-oncology specialties;
3. Pure PBL or CBL without MDT component;
4. Online-only interventions;
5. Qualitative outcomes only;

6. Incomplete data for meta-analysis.

Information sources

Databases: PubMed, Web of Science, Education Resources Information Center (ERIC), Chinese National Knowledge Infrastructure (CNKI), Weipu database, and Wanfang database.

Main outcome(s)

Primary outcomes include satisfaction rates (dichotomous), theoretical knowledge examination scores, operational skills assessment scores, and case analysis abilities scores (continuous).

Additional outcome(s)

Secondary outcomes may include critical thinking scores, communication skills assessments, and long-term retention of knowledge where reported.

Data management

Two reviewers will independently screen titles, abstracts, and full texts using standardized forms. Disagreements will be resolved through discussion with a third reviewer. Data extraction will include study characteristics (first author, publication year, country, study design, sample size, setting), participant characteristics (educational level, training year), intervention details (specific MDT approach, duration, frequency), control intervention description, and outcomes (for dichotomous outcomes: number of events and total participants per group; for continuous outcomes: means, standard deviations, and sample sizes per group).

Quality assessment / Risk of bias analysis

Study quality will be assessed using Cochrane Risk of Bias 2.0 for randomized controlled trials and Newcastle-Ottawa Scale for observational studies. Two researchers will independently assess the risk of bias and applicability of the included studies and cross-check the results. In case of disagreement, a third researcher will be consulted to reach a consensus. Assessment domains will include randomization, allocation concealment, blinding, incomplete outcome data, selective reporting, and other bias sources.

Strategy of data synthesis

Random-effects meta-analyses will be performed using R software (version 4.2.1) with the 'meta' package, employing the DerSimonian-Laird method with Hartung-Knapp adjustment. For satisfaction (dichotomous outcome), odds ratios (OR) with 95% confidence intervals will be calculated using Mantel-Haenszel method. For examination scores (continuous outcomes), standardized mean differences (SMD) using Hedges' g with bias correction will be calculated.

Statistical heterogeneity will be quantified using Cochran's Q-test ($p < 0.10$ indicating significant heterogeneity), I^2 statistic ($< 25\%$ = low, $25-50\%$ = moderate, $> 50\%$ = substantial heterogeneity), and τ^2 (between-study variance).

Subgroup analysis

Pre-specified subgroup analyses will be conducted by teaching method combination (MDT+PBL, MDT+CBL, MDT+PBL+CBL), study design (RCT vs. cohort), and geographic region.

Sensitivity analysis

Leave-one-out sensitivity analysis will be performed to assess whether any single study disproportionately influences pooled estimates. Publication bias will be assessed visually using funnel plots and, when ≥ 10 studies are available, statistically using Egger's regression test ($p < 0.10$ indicating asymmetry).

Language restriction English and Chinese.

Country(ies) involved China.

Other relevant information

This systematic review and meta-analysis will be conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. The study protocol has been prospectively registered to ensure transparency and reduce reporting bias.

Keywords

Multidisciplinary team learning, radiation oncology education, problem-based learning, case-based learning, medical education, meta-analysis.

Dissemination plans

Results will be submitted for publication in a peer-reviewed medical education or radiation oncology journal. Findings will be presented at relevant medical education conferences and shared with radiation oncology residency program directors to inform curriculum development. A summary of results will be made available to study participants and relevant professional organizations.

Contributions of each author

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