



Oncology Education in Undergraduate Medical Training: A Review of Educational Approaches, Curriculum Challenges, and Localization Requirements in Iran with a Comparative Perspective on International Experiences

*Zahra Rezaei Borojerdi¹

¹Medical Oncologist, Hematologist, and Stem Cell Transplantation Specialist, Department of Hematology and Oncology, Imam Reza Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

Abstract

Background: The escalating cancer burden and the pivotal role of primary-care physicians in prevention, early diagnosis, and timely referral highlight the urgent need to reform undergraduate oncology education. This study evaluated undergraduate oncology training in Iran, compared it with international benchmarks, and proposed context-sensitive recommendations for curriculum reform.

Materials and Methods: A structured critical narrative review was conducted per the SANRA guidelines. English- and Persian-language sources up to March 31, 2026, were searched across PubMed/MEDLINE, Scopus, Web of Science, ERIC, Google Scholar, SID, CIVILICA, and ISC, as well as relevant organizational websites. Two reviewers independently screened studies. Data were synthesized thematically across curricular structure, teaching and assessment strategies, international competency benchmarks (ASCO/ESMO, CanMEDS/EPAs), and sociocultural adaptation.

Results: Undergraduate oncology education in Iran is fragmented, compartmentalized across inpatient and subspecialty disciplines, and lacks a longitudinal curriculum map. Major gaps were identified in core general-practice competencies: primary prevention, screening, early detection, oncologic emergencies, cancer survivorship, and structured palliative care. Teaching relies heavily on passive lectures with minimal ambulatory, primary-care, simulation-based, or interprofessional training, and culturally sensitive communication (e.g., breaking bad news using SPIKES amid protective family collusion) is inadequately taught. Assessment remains predominantly knowledge-based, with limited workplace-based tools (OSCE, Mini-CEX, DOPS). International comparisons supported longitudinal cancer education, community-based ambulatory rotations, and competency-driven EPAs.

Conclusion: Reforming undergraduate oncology education in Iran requires a longitudinal, competency-based, integrated curriculum aligned with primary healthcare needs. Strategic priorities include formulating national core oncology EPAs, expanding ambulatory and community-based exposure, embedding palliative and supportive care, integrating simulation for complex communication, and deploying programmatic, workplace-based assessments.

Key Words: Competency-Based Medical Education, Iran, Oncology Education, Palliative Care, Undergraduate Medical Education.

*Please cite this article as: Rezaei Borojerdi Z. Oncology Education in Undergraduate Medical Training: A Review of Educational Approaches, Curriculum Challenges, and Localization Requirements in Iran with a Comparative Perspective on International Experiences. Med Edu Bull 2026; 7(2): 1263-84. DOI: 10.22034/meb.2026.599486.1141

*Corresponding Author:

Zahra Rezaei Borojerdi, MD, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

Email: rezaeibz@mums.ac.ir

Received date: Mar. 31, 2026; Accepted date: Aug.28, 2026

1- INTRODUCTION

Cancer is a major global health challenge and one of the leading causes of death worldwide (1). Its increasing incidence and mortality are driven by population ageing, population growth, and modifiable risk factors, including tobacco use, unhealthy diets, obesity, physical inactivity, alcohol consumption, and environmental exposures (2, 3). These trends highlight the need to strengthen undergraduate medical education, as general practitioners are often the first point of contact for patients with suspected cancer and play a crucial role in prevention, risk assessment, screening, early diagnosis, initial evaluation, and timely referral to specialized services (4, 5).

Despite this need, undergraduate oncology education in many medical schools remains fragmented, with limited curricular integration, inadequate clinical exposure, and continued reliance on traditional, knowledge-based teaching methods (6, 7). International oncology organizations, including the European Society for Medical Oncology (ESMO) and the American Society of Clinical Oncology (ASCO), emphasize structured competency-based education covering cancer prevention and control, fundamental oncology principles, supportive and palliative care, treatment-related complications, multidisciplinary decision-making, and patient-centered communication (8, 9). Communication skills—such as breaking bad news through structured frameworks like SPIKES, discussing prognosis, responding to emotions, supporting shared decision-making, and addressing patients' psychosocial needs—are essential components of contemporary cancer care and should be introduced during undergraduate training (10, 11).

In Iran, oncology-related content is distributed across several stages and

disciplines of the undergraduate medical curriculum, including basic sciences, pathophysiology, clerkship, internship, internal medicine, surgery, pediatrics, obstetrics and gynecology, and pathology (12, 13). However, this distribution does not necessarily ensure curricular continuity or the progressive development of core competencies. The resulting fragmentation can result in inconsistent learning experiences and variable preparation for early cancer detection and referral, as well as insufficient attention to supportive and palliative care (14, 15).

Accordingly, this review aimed to comprehensively examine the current status, educational approaches, and curriculum-related challenges of undergraduate oncology education in Iran; compare them with international standards and selected educational experiences; and propose practical recommendations for revising, integrating, and contextually adapting oncology and palliative-care education within Iranian medical schools (7, 16).

2- MATERIALS AND METHODS

2-1. Study Design and Reporting Framework

This study was conducted as a structured critical narrative review to examine educational approaches, expected competencies, curriculum-related challenges, and teaching and assessment methods in undergraduate oncology education in Iran. The current status of oncology education in Iran was compared with selected international recommendations, competency frameworks, and educational models to develop feasible, contextually appropriate recommendations for curriculum reform (17).

The review was reported with consideration of the key domains of the Scale for the Assessment of Narrative

Review Articles (SANRA), including justification of the review's importance, clearly defined aims, description of the literature search, appropriate referencing, scientific reasoning, and presentation of relevant data (18). SANRA was used as a reporting and quality-consideration framework rather than as a formal risk-of-bias assessment tool. Given the heterogeneity of study designs, educational settings, interventions, and reported outcomes, meta-analysis was not undertaken. Instead, findings were integrated through narrative and thematic synthesis (19).

2-2. Information Sources and Search Strategy

The literature search covered the period from database inception to March 31, 2026, with no restrictions on publication date. Studies published in English or Persian were eligible for inclusion. International databases searched included PubMed/MEDLINE, Scopus, Web of Science Core Collection, ERIC, and Google Scholar. To identify Iran-specific studies, reports, and educational documents, the Scientific Information Database (SID), CIVILICA, and the Islamic World Science Citation Center (ISC) were also searched.

Relevant policy documents, curricula, professional guidelines, and grey literature were identified through manual searches of the websites of the World Health Organization (WHO), the International Agency for Research on Cancer (IARC), the European Society for Medical Oncology (ESMO), the American Society of Clinical Oncology (ASCO), and the Secretariat of the Council for Undergraduate Medical Education of Iran's Ministry of Health and Medical Education (3, 8, 12).

The search strategy combined controlled vocabulary, including Medical Subject Headings (MeSH), with free-text terms

searched in titles and abstracts. Boolean operators (AND and OR) were used to combine concepts related to undergraduate medical education, oncology, curriculum, palliative care, Iran, and international educational models.

The PubMed/MEDLINE search strategy was as follows:

("Education, Medical, Undergraduate"[Mesh] OR "Medical Education"[Mesh] OR "Curriculum"[Mesh] OR "undergraduate medical education" OR "medical student*" OR "medical curriculum" OR "medical school*") AND ("Medical Oncology"[Mesh] OR "Neoplasms"[Mesh] OR "oncology education" OR "cancer education" OR "cancer curriculum" OR "oncology training" OR "palliative care education") AND ("Iran"[Mesh] OR Iran OR Iranian OR "global curriculum" OR international OR comparative)

For Persian-language databases, the following terms were searched individually and in combination: "oncology education," "cancer education," "undergraduate medical education," "medical curriculum," "palliative care," "supportive care," "communication skills in oncology," "breaking bad news," and "clinical competencies." Backward and forward citation tracking was also performed by reviewing the reference lists of key publications and relevant guideline documents, as well as articles citing those sources.

2-3. Study Selection

Search results were imported into EndNote 21, and duplicate records were removed. Two reviewers independently screened the titles and abstracts of retrieved records. The full texts of potentially eligible sources were subsequently assessed according to predefined inclusion and exclusion criteria.

Disagreements regarding eligibility were resolved through discussion. When consensus could not be reached, a third reviewer with expertise in medical

education and research methodology made the final decision. The numbers of identified, duplicate, excluded, and included sources were documented to enhance transparency in the selection process.

2-4. Eligibility Criteria

2-4-1. Inclusion Criteria

The following sources were eligible for inclusion:

- Original quantitative, qualitative, and mixed-methods studies; educational evaluations; needs-assessment studies; review articles; consensus statements; guidelines; and relevant curriculum documents.
- Sources addressing oncology education, cancer biology, cancer prevention, screening, early diagnosis, referral principles, supportive care, or palliative care in undergraduate medical education (5, 7, 16).
- Studies evaluating oncology teaching or assessment approaches, including problem-based learning, case-based learning, simulation, patient-based teaching, digital education, gamification, just-in-time teaching, and team-based learning (15, 16).
- Sources addressing pain management, palliative care, communication skills, breaking bad news, or the SPIKES protocol among medical students (10, 11, 14).
- Studies conducted in Iran, as well as selected international sources presenting competency frameworks, curricula, educational models, or transferable experiences relevant to undergraduate medical education (6, 12, 13).
- Full-text publications available in English or Persian.

2.4.2. Exclusion Criteria

The following sources were excluded:

- Studies exclusively addressing postgraduate oncology education, residency, fellowship training, or continuing professional development for oncology specialists without a clear connection to undergraduate medical education.
- Studies focusing exclusively on nursing, pharmacy, dentistry, or other health-profession education, unless they evaluated interprofessional educational programs that included medical students.
- Biomedical, cellular, molecular, diagnostic, or therapeutic studies without an explicit medical education component.
- Letters without clear methods or data, news reports, non-scholarly commentaries, conference abstracts without full-text publications, and duplicate records.

2-5. Data Extraction and Synthesis

Data from included sources were recorded in a researcher-developed extraction form in Microsoft Excel. Extracted variables included author(s), publication year, country or institution, study design, target population, stage of medical training, educational content, teaching methods, assessment methods, target competencies, implementation barriers, reported educational outcomes, and key recommendations.

Where reported, the stage of training was classified as basic sciences, pathophysiology, clinical clerkship, or internship. Teaching approaches were categorized as lecture-based, interactive, case-based, problem-based, bedside- or patient-based, simulation-based, digital, or asynchronous learning. Assessment methods included multiple-choice

questions (MCQs), objective structured clinical examinations (OSCEs), direct observation of procedural skills (DOPS), and Mini-Clinical Evaluation Exercises (Mini-CEX).

Because of substantial heterogeneity in study designs, educational interventions, and outcome measures, a meta-analysis was not feasible. Data were therefore analyzed using narrative and thematic synthesis. Findings were organized into three main domains:

- The structure, content, and challenges of undergraduate oncology education in Iran.
- Core competencies, teaching approaches, and assessment models described in international frameworks and educational experiences.
- Recommendations for revising, integrating, and contextually adapting oncology, supportive-care, and palliative-care education in Iranian medical universities (4, 8, 9, 13, 15).

2-6. Ethical Considerations

This study was based exclusively on published literature and publicly available documents. It did not involve human participants, clinical interventions, or the collection of identifiable personal data. Therefore, informed consent and institutional ethical approval were not required, subject to applicable institutional policies. Nevertheless, the authors adhered to the principles of research integrity, accurate citation, avoidance of selective or misleading reporting, respect for intellectual property, and established standards of publication ethics.

3- RESULTS

The critical synthesis of published studies, curriculum documents, and professional guidelines identified through March 31, 2026, provided a multidimensional overview of the

structure, content, competencies, teaching and assessment approaches, implementation challenges, and requirements for contextual adaptation in undergraduate oncology education. In accordance with the objectives of this review, the findings were organized into nine thematic domains: (1) the position of oncology education within the undergraduate medical curriculum; (2) core competencies; (3) supportive and palliative care; (4) communication skills and ethics; (5) teaching approaches; (6) competency assessment; (7) comparison with international models; (8) challenges in Iran; and (9) requirements for curriculum revision and contextual adaptation.

Three analytical tables were developed. **Table 1** presents a proposed stage-specific matrix of oncology competencies, teaching methods, and assessment approaches across the preclinical, clerkship, and internship phases. **Table 2** compares key gaps in undergraduate oncology education in Iran with selected international benchmarks. **Table 3** summarizes structural and sociocultural barriers, context-sensitive educational strategies, and anticipated educational and health-system outcomes.

3-1. Position of Oncology Education in Undergraduate Medical Training

The reviewed literature indicated that, in many established medical education systems, undergraduate oncology education is most effectively delivered as an integrated and longitudinal program rather than as a short, isolated course. Foundational concepts—including carcinogenesis, tumor biology, cancer genetics, pathology, epidemiology, prevention, and screening—are introduced during the preclinical phase and subsequently reinforced through clinical education focused on early diagnosis, staging, treatment principles, supportive

care, palliative care, and follow-up (7–9, 16, 20, 21).

In Iran, cancer-related content is distributed across basic sciences, pathophysiology, pathology, internal medicine, hematology and oncology, surgery, obstetrics and gynecology, pediatrics, and, in some medical schools, radiation oncology (12, 13). Although this distribution may expose students to cancer from several disciplinary and clinical perspectives, the absence of an explicit and unified curriculum map may result in duplication of content, discontinuity between basic and clinical training, and inconsistent coverage of essential competencies (6, 7, 12, 13, 16).

Within a longitudinal curriculum, each competency should be explicitly mapped to the stage at which it is introduced, reinforced, practiced, and assessed. Without such mapping, students' learning opportunities may depend excessively on institutional context, the availability of patients with cancer, teaching-hospital capacity, faculty engagement, and incidental clinical exposure (13, 15, 16). The proposed progression of oncology content, teaching approaches, and assessment methods across the preclinical, clerkship, and internship stages is presented in **Table 1**.

3-2. Core Competencies for Medical Students

The synthesis indicated that undergraduate oncology competencies should align with the anticipated responsibilities of future general physicians, particularly in primary prevention, early recognition, preliminary evaluation, initial clinical decision-making, referral, symptom assessment, communication, and follow-up. The undergraduate curriculum should not aim to provide subspecialty-level mastery of cancer treatment. Rather, it should prepare students to identify potentially malignant conditions, provide safe initial care,

recognize urgent presentations, communicate appropriately, and coordinate referral to specialist and palliative-care services (3, 5, 7, 16, 20, 21).

3-2-1. Cancer Prevention and Risk Reduction

Medical students should understand major modifiable cancer risk factors, including tobacco use, obesity, physical inactivity, unhealthy dietary patterns, alcohol consumption, oncogenic infections, and occupational or environmental exposures. They should also be able to provide basic counseling on smoking cessation, healthy lifestyle practices, vaccination where appropriate, and other feasible risk-reduction strategies (1, 3, 5).

This competency is important because cancer control extends beyond the diagnosis and treatment of established malignancy. General physicians have a central role in primary prevention, identification of high-risk individuals, patient counseling, implementation of preventive interventions, and referral to appropriate screening or preventive services. International guidance emphasizes strengthening primary-care capacity for prevention, early detection, and follow-up throughout the cancer-care continuum (3, 5, 20).

3-2-2. Screening and Early Diagnosis

Education on screening and early diagnosis should prepare students to understand the purpose, target population, potential benefits, limitations, and harms of screening interventions, as well as the appropriate follow-up of abnormal findings. Students should also recognize common warning signs of malignancy, including unexplained weight loss, abnormal bleeding, persistent masses, suspicious skin lesions, persistent gastrointestinal or respiratory symptoms, and newly emerging neurological symptoms (5, 20).

At the undergraduate level, the expected role of future general physicians is not to establish a definitive diagnosis for every suspected cancer. Rather, students should learn to recognize possible malignancy, initiate an appropriate preliminary evaluation, provide safety-netting where necessary, minimize avoidable diagnostic delays, and arrange timely referral (5, 6, 20). Teaching in this area should be grounded in common clinical scenarios and realistic referral pathways within the Iranian health system.

3-2-3. Cancer Biology and Pathology

The reviewed literature emphasized the importance of teaching carcinogenesis, the distinction between benign and malignant neoplasms, tumor grading and staging, prognostic factors, and the clinical relevance of pathology in cancer care (7–9, 16, 21). At the undergraduate level, these concepts should be taught through an applied and clinically oriented approach so that students can connect clinical manifestations with histopathological findings, diagnostic imaging, disease stage, and referral decisions.

Familiarity with the Tumor, Node, Metastasis (TNM) classification system and the practical relevance of basic molecular and pathological markers provides a foundation for understanding multidisciplinary cancer management. The educational objective is not subspecialty-level memorization, but rather the ability to interpret basic staging concepts and appreciate their implications for prognosis, treatment planning, and timely referral (8, 9, 21).

3-2-4. Treatment Principles and Multidisciplinary Care

Medical students should be familiar with the broad purposes, indications, common toxicities, monitoring requirements, and referral implications of surgery, radiotherapy, chemotherapy, targeted therapy, immunotherapy, hormonal

therapy, and combined treatment modalities (8, 9, 21).

International oncology frameworks emphasize that cancer care requires coordinated input from medical oncologists, surgeons, radiation oncologists, pathologists, radiologists, nurses, psychosocial professionals, and palliative-care teams (8, 9, 21, 22). Structured observation of multidisciplinary team meetings or tumor boards may improve students' understanding of how clinical, imaging, pathological, prognostic, and patient-preference information is integrated into treatment decisions (8, 9, 21, 22).

3-2-5. Oncologic Emergencies

Early recognition of oncologic emergencies is an essential competency for future general physicians. Important conditions include febrile neutropenia, tumor lysis syndrome, malignancy-associated hypercalcemia, spinal cord compression, superior vena cava syndrome, and acute toxicities associated with anticancer therapy (8, 9, 20, 21).

Students should be able to identify potentially life-threatening presentations, initiate immediate stabilization and appropriate first-line measures within the scope of their training, and arrange urgent referral to specialist or emergency services. Case-based learning, simulation, and decision-focused assessment may be more appropriate than memorization-based teaching for these conditions (8, 9, 20–22). The staged progression of these competencies is incorporated into the broader curriculum matrix in **Table 1**.

3-3. Supportive and Palliative Care Education

Supportive and palliative care are essential components of undergraduate oncology education. The World Health Organization recommends integrating palliative care across all levels of health systems,

including primary care, and incorporating relevant competencies into the education of health professionals (11). Palliative care should be introduced according to patient and family needs from the time of diagnosis of a serious illness and should not be restricted to the final days of life.

Evidence from Iran suggests gaps in standardized palliative-care content, clinical learning opportunities, and healthcare providers' preparedness to address the needs of patients with cancer and their families (14, 21). Simulation, role-play, and digital learning resources may help provide structured preparation for communication, symptom assessment, and supportive-care learning when direct clinical exposure is limited (23, 24). Medical students have also reported a need for more structured and clinically relevant undergraduate oncology education, including practical preparation for patient-centered care, communication, and the supportive needs of patients with cancer (25).

Undergraduate education should include the assessment and initial management of pain, nausea and vomiting, dyspnea, constipation, delirium, fatigue, anxiety, and nutritional concerns (11, 26–28). Students should also learn to discuss goals of care, support family caregivers, identify when specialist palliative-care consultation is needed, and provide compassionate end-of-life care (11, 25–28).

Longitudinal integration of supportive and palliative care across internal medicine, oncology, family medicine, emergency medicine, and community- or home-care settings may enhance the relevance and transferability of learning (11, 14, 25–28). Evidence from Iranian general practitioners also indicates that palliative-care practice is influenced by system-level limitations, variable training opportunities, and challenges in coordinating care for patients with serious illness and their families (29). Basic symptom assessment,

supportive-care principles, and referral to palliative-care services should be introduced during clinical clerkship. More advanced symptom management, goals-of-care discussions, and end-of-life care should be reinforced during the internship stage, as outlined in **Table 1**. Relevant gaps in comparison with international models are summarized in **Table 2**.

3-4. Communication Skills and Medical Ethics

Communication is particularly important in oncology because patients and families often experience uncertainty, existential distress, complex clinical decisions, financial burdens, and substantial psychosocial consequences. Medical students should develop foundational skills for discussing suspected malignancy, explaining diagnostic processes, responding empathically to intense emotions, safeguarding patient autonomy and confidentiality, involving family members appropriately, and maintaining realistic hope (10, 23, 25, 29–31).

The SPIKES protocol—Setting up the interview, assessing the patient's Perception, obtaining the patient's Invitation, giving Knowledge, addressing Emotions with empathic responses, and developing a Strategy and Summary—provides an established structured framework for teaching the delivery of bad news (10, 31). However, its implementation in Iran requires culturally responsive adaptation to address family involvement in decision-making, protective withholding of information, cancer-related stigma, and variation in local sociocultural norms (14, 23, 24, 29).

Communication training should extend beyond bad-news disclosure. Core curricular components should include shared decision-making, informed-consent processes, communication of prognosis and realistic goals of care, management of prognostic uncertainty, and management

of patient–family disagreements (10, 27–31). These competencies are consistent with the roles articulated in the CanMEDS Physician Competency Framework, particularly the Communicator, Professional, Collaborator, and Health Advocate roles (32). Communication education should also promote collaboration with oncology, palliative-care, nursing, psychosocial, and other relevant healthcare professionals. Interprofessional learning can help students understand professional roles, improve team communication, and support coordinated, patient- and family-centered cancer care (33).

Experiential approaches, including standardized patients, simulated role-play, structured debriefing, and direct performance assessment, are suitable methods for developing and evaluating these interpersonal competencies (23, 31, 34). Context-sensitive communication strategies for Iran are summarized in **Table 3**.

3-5. Teaching Approaches in Oncology Education

The findings support a longitudinal and integrated approach in which cancer biology and pathology are introduced during the preclinical years and progressively linked to prevention, diagnosis, treatment, complications, supportive care, palliative care, and communication during clinical training (7, 8, 12, 16, 21). Effective implementation requires curriculum mapping, cross-departmental coordination, and stage-specific learning outcomes (12, 13, 16, 33).

Case-based and problem-based learning can help students integrate basic sciences, pathology, pharmacology, communication, and clinical reasoning across the cancer-care pathway (7, 16, 25, 33). Clinical placements should include active participation, explicit learning objectives,

direct observation, feedback, and workplace-based assessment rather than passive attendance alone (13, 15, 32). Tumor boards can further support students' understanding of multidisciplinary treatment planning and the integration of clinical, radiological, pathological, and patient-preference information in decision-making (8, 9, 21, 22).

Simulation and standardized patients are valuable for teaching bad-news delivery, prognosis discussions, informed consent, emotional responses, oncologic emergencies, symptom management, and palliative-care communication (10, 27–31, 34). Realistic, culturally adapted scenarios and structured debriefing are essential, particularly in relation to family roles and communication norms in Iran (10, 23, 24, 29, 31, 34). Digital resources can supplement—but should not replace—clinical teaching. Blended learning that combines online modules with bedside teaching, simulation, and faculty feedback is recommended (15, 24, 25, 35).

3-6. Assessment of Learning and Competence

The findings indicated that assessment strategies should be aligned with intended oncology competencies. Written examinations can assess foundational knowledge and the application of concepts to clinical scenarios; however, they cannot independently evaluate physical examination, communication, symptom management, teamwork, clinical reasoning, or ethical decision-making.

Objective Structured Clinical Examinations (OSCEs) may include stations on history-taking for a patient with suspected cancer, explaining a diagnostic pathway, delivering bad news, assessing cancer-related pain, recognizing febrile neutropenia, and discussing palliative care (10, 31, 32, 34, 36). In clinical settings, Mini-Clinical Evaluation Exercises (Mini-

CEX), Direct Observation of Procedural Skills (DOPS), case-based discussions, logbooks, direct observation, and multisource feedback can be used to assess students' performance-based competencies (30, 32, 36).

Assessment should be longitudinal and programmatic, combining multiple methods and observations over time rather than relying on a single examination (36). The alignment of core oncology content, instructional methods, and assessment tools across the preclinical, clerkship, and internship stages is summarized in **Table 1**.

3-7. Comparison of Iran with International Models

International frameworks generally emphasize competency-based, longitudinal, patient-centered, and multidisciplinary education. Although many educational frameworks developed by the European Society for Medical Oncology (ESMO) and the American Society of Clinical Oncology (ASCO) were designed primarily for postgraduate oncology training, their core domains remain informative for defining foundational undergraduate competencies, including cancer biology, multimodal treatment, supportive care, complication management, communication, and interprofessional collaboration (8, 9, 21, 22).

In Iran, oncology-related content is included across several areas of undergraduate medical education; however, the available evidence indicates a need for stronger curricular integration, clearer definitions of graduation competencies, and closer alignment between assessment methods and educational objectives (12, 13, 16, 23–25, 32, 35, 36). Mixed-methods approaches can support the integrated examination of quantitative curriculum data and qualitative stakeholder perspectives during

curriculum evaluation and revision (37, 38). Recent evidence on undergraduate oncology education in general medicine further highlights the need to identify curriculum gaps, consider international models, and develop contextually appropriate approaches for oncology education in Iran (39).

International models should not be adopted uncritically. Contextual adaptation is necessary to ensure alignment with Iran's cancer profile, primary-care and referral systems, regional inequalities in access, teaching-hospital capacity, diagnostic and treatment resources, and the role of families in healthcare decision-making (1–3, 12, 14, 23, 24, 28, 30, 39). **Table 2** compares key undergraduate oncology curriculum domains, international benchmarks, the current situation in Iran, and priority areas for revision.

3-8. Major Challenges in Iran

The challenges facing oncology education in Iran are interconnected across curricular, clinical, assessment, and sociocultural domains. At the curricular level, key concerns include fragmented content, the absence of a comprehensive competency map, insufficient distinction between the competencies required of general practitioners and those required of subspecialists, and an emphasis on memorization-based learning. Prevention, early diagnosis, supportive care, palliative care, and communication skills may be addressed less systematically than diagnostic and treatment-related topics (6, 7, 12, 16, 39).

At the clinical level, opportunities for exposure to patients with cancer, tumor boards, and palliative-care teams vary across universities and teaching hospitals. High patient volumes, overcrowded clinical settings, limited faculty time, and insufficient opportunities for structured feedback may constrain effective clinical teaching (13, 15, 25).

The predominance of written examinations and limited use of standardized patients, simulation, and workplace-based assessment may result in inadequate evaluation of practical, communication, and ethical competencies (32, 34, 36). In addition, family involvement in disclosure and decision-making, cancer- and death-related stigma, and cultural diversity across settings reinforce the need for context-specific communication training (10, 14, 29). These multidimensional barriers and corresponding context-sensitive educational strategies are summarized in **Table 3**.

3-9. Requirements for Curriculum Revision and Contextual Adaptation

The findings suggest that revision of undergraduate oncology education in Iran should be based on a longitudinal, integrated, and competency-based curriculum. The curriculum should begin with foundational cancer concepts and progressively address prevention, screening, early diagnosis, referral, major treatment modalities, oncologic emergencies, supportive care, palliative care, and communication with patients and families (7, 16, 20, 21, 39).

Developing a national set of minimum oncology competencies for graduating

medical students would be an important first step. These competencies should focus on tasks that general practitioners are expected to perform within the Iranian health system: identifying risk factors and warning signs; counseling patients on prevention and screening; initiating an appropriate preliminary evaluation; arranging timely referral; providing initial symptom management; recognizing oncologic emergencies; communicating effectively with patients and families; and coordinating care with specialist and palliative-care teams (3, 5, 11, 20, 30, 32).

Implementation of a revised program requires a combination of case-based learning, simulation, tumor boards, interprofessional education, digital learning resources, and performance-based assessment. Ongoing evaluation involving students, faculty members, general practitioners, patients, family caregivers, and policymakers may support iterative improvement and enhance the curriculum's responsiveness to national needs (13, 15, 22, 34–36, 39). **Table 3** synthesizes the principal structural and sociocultural challenges, proposed context-sensitive educational strategies, and anticipated educational and health-system outcomes.

Table-1: Proposed Stage-Specific Competency, Teaching, and Assessment Matrix for Undergraduate Oncology Education.

Educational stage	Key oncology content and competencies	Suggested teaching methods	Assessment methods	Supporting references
Preclinical phase (basic sciences and pathophysiology)	Tumor biology and molecular pathogenesis; carcinogenesis; principles of cancer epidemiology, prevention, and screening; cancer genetics; foundational pathology; and pharmacology of anticancer agents.	Interactive lectures; team-based learning (TBL); case-triggered basic-science discussions; virtual learning; and multimedia self-learning modules.	Scenario-based multiple-choice questions (MCQs); short-answer questions (SAQs); online formative quizzes; and case-based written examinations.	(1, 3, 5, 7–9, 12, 16, 20, 21, 33, 35)

Educational stage	Key oncology content and competencies	Suggested teaching methods	Assessment methods	Supporting references
Clinical clerkship	History-taking and physical examination; recognition of warning signs of malignancy; preliminary evaluation and referral; introductory interpretation of pathology reports; basic TNM staging; recognition of common treatment toxicities; basic symptom assessment; supportive-care principles; referral to palliative-care services; patient-centered communication; explanation of diagnostic pathways; and response to emotional distress.	Bedside teaching; case-based learning (CBL); problem-based learning (PBL); supervised symptom-assessment encounters; guided observation of multidisciplinary tumor boards; and structured feedback.	Objective Structured Clinical Examination (OSCE); logbook review; key-feature clinical reasoning tests; case-based discussions (CBDs); and direct observation.	(5–9, 11–16, 20, 21, 23–25, 30–33, 36, 39)
Internship	Initial stabilization and urgent referral of oncologic emergencies; febrile neutropenia triage; symptom control; palliative and end-of-life care; goals-of-care discussions; application of the SPIKES protocol; communication about prognosis; management of patient–family disagreements; use of primary-care referral pathways; and coordination with specialist and palliative-care teams.	Clinical rotations in oncology, emergency medicine, and palliative-care settings; standardized-patient simulation; complex case analysis; joint palliative-care rounds; interprofessional learning (IPL); and structured debriefing.	Mini-Clinical Evaluation Exercises (Mini-CEX); multisource feedback (MSF); case-based discussions (CBDs); Direct Observation of Procedural Skills (DOPS); OSCE stations; and reflective logbooks.	(3, 5, 8–11, 14, 20, 21, 23–32, 34, 36, 39)

Abbreviations: CBD, Case-Based Discussion; CBL, Case-Based Learning; DOPS, Direct Observation of Procedural Skills; IPL, Interprofessional Learning; MCQ, Multiple-Choice Question; Mini-CEX, Mini-Clinical Evaluation Exercise; MSF, Multisource Feedback; OSCE, Objective Structured Clinical Examination; PBL, Problem-Based Learning; SAQ, Short-Answer Question; SPIKES, Setting, Perception, Invitation, Knowledge, Emotions with empathic responses, Strategy and Summary; TBL, Team-Based Learning; TNM, Tumor, Node, Metastasis.

Note: This table presents a proposed stage-specific framework for undergraduate oncology education. It does not represent a currently implemented national curriculum.

Table-2: Key Gaps in Undergraduate Oncology Education in Iran Compared With International Models.

Curriculum component	International benchmarks	Current situation in Iran	Priority for revision	References
Curriculum structure	Longitudinal, competency-based, and multidisciplinary education with explicit learning outcomes and curriculum mapping.	Content is distributed across departments, potentially resulting in discontinuity between the basic-science and clinical phases and variability in students' learning opportunities.	Develop a national curriculum map and a stage-specific competency framework.	(6–9, 12, 13, 16, 21, 22, 30, 33, 36, 39)
Palliative care and symptom management	Early integration of palliative care and structured training in symptom assessment, symptom management, referral, and end-of-life care.	Fragmented content, limited standardized instruction, and limited clinical exposure to palliative-care services.	Establish formal curriculum content and expand clinical, community-based, and palliative-care learning settings.	(11, 14, 23, 24, 26–28)
Communication and ethics	Skills-based education using simulation, standardized patients, the SPIKES protocol, shared decision-making, and performance-based assessment.	Predominantly theoretical teaching and unstructured clinical exposure, with limited formal preparation for culturally responsive patient–family communication.	Develop context-sensitive communication scenarios and performance-based assessment approaches.	(10, 23–25, 29, 31, 34)
Multidisciplinary care	Structured student participation in, or observation of, tumor boards and interprofessional cancer-care teams.	Variable and often limited student access to tumor boards and coordinated cancer-care settings.	Use tumor boards purposefully as educational settings and integrate interprofessional learning.	(8, 9, 21, 22)
Prevention, screening, and primary care	Strong emphasis on prevention, risk reduction, screening, early diagnosis, safety-netting, and timely referral.	Greater emphasis on diagnosis and advanced treatment-related content than on prevention, screening, warning signs, and primary-care referral pathways.	Strengthen education on prevention counseling, screening principles, warning signs, preliminary evaluation, safety-netting, and referral pathways.	(1, 3, 5, 6, 20)
Assessment of competence	Programmatic assessment using written tests, OSCEs, workplace-based assessment (WPBA), feedback, and multiple sources of evidence.	Predominance of knowledge-based written examinations and limited assessment of practical, communication, and professional competencies.	Introduce oncology-specific OSCE stations and workplace-based assessment methods, including Mini-CEX, DOPS, CBDs, and multisource feedback.	(25, 30, 32, 34, 36)

Abbreviations: CBD, Case-Based Discussion; DOPS, Direct Observation of Procedural Skills; Mini-CEX, Mini-Clinical Evaluation Exercise; OSCE, Objective Structured Clinical Examination; SPIKES, structured protocol for delivering bad news; WPBA, Workplace-Based Assessment.

Note: International benchmarks summarize recurring domains identified in selected international oncology education frameworks and curriculum literature. The current situation in Iran reflects the predominant patterns and gaps reported in the reviewed literature and may vary across medical schools and clinical training settings.

Table-3: Structural and Sociocultural Challenges, Context-Sensitive Strategies, and Expected Outcomes for Undergraduate Oncology Education in Iran.

Challenge level	Identified barriers	Proposed context-sensitive strategies	Expected educational and health-system outcomes	References
Curriculum	Fragmented content; unclear distinction between general-practitioner and subspecialist competencies; limited curriculum mapping; and excessive emphasis on memorization-based content.	Develop national core competencies for undergraduate oncology education and create a longitudinal curriculum based on common cancers, primary-care roles, local needs, and realistic referral pathways.	Clearer learning outcomes; greater standardization across medical schools; reduced unnecessary content duplication; and improved preparation for primary care and referral.	(6, 7, 12, 13, 16, 20, 21, 30, 33, 39)
Clinical environment	High patient volumes; overcrowded teaching settings; faculty workload and burnout; limited time for bedside teaching, direct observation, and feedback; and limited exposure to tumor boards or palliative-care teams.	Use blended learning to protect clinical teaching time; implement small-group teaching; establish structured feedback processes; and provide scheduled tumor-board observation and supervised palliative-care encounters.	Improved faculty–student interaction; enhanced clinical reasoning; more consistent clinical exposure; and a stronger understanding of multidisciplinary and supportive care.	(13, 15, 24–26, 29, 31, 34, 35)
Assessment	Predominance of knowledge-based multiple-choice examinations and limited assessment of practical, communication, ethical, and teamwork skills.	Develop oncology-specific OSCE stations and use Mini-CEX, DOPS, CBDs, direct observation, reflective logbooks, and multisource feedback.	Improved assurance of practical, communication, ethical, and professional competence; and better alignment between learning outcomes and assessment.	(10, 25, 30–32, 34, 36)
Sociocultural context	Strong family involvement in disclosure and decision-making; protective withholding of information; cancer- and death-related stigma; and diversity in local beliefs and	Adapt communication scenarios to local cultural norms; teach shared decision-making, patient autonomy, culturally responsive family engagement, and management of patient–family conflict; and use	Improved communication quality; greater learner preparedness; more ethical and culturally responsive care; and enhanced patient and family satisfaction.	(10, 14, 23, 24, 28, 29, 31)

Challenge level	Identified barriers	Proposed context-sensitive strategies	Expected educational and health-system outcomes	References
	communication norms.	simulated patients with structured debriefing.		

Abbreviations: CBD, Case-Based Discussion; DOPS, Direct Observation of Procedural Skills; Mini-CEX, Mini-Clinical Evaluation Exercise; OSCE, Objective Structured Clinical Examination.

Note: The proposed strategies are derived from the critical synthesis of the reviewed literature and are intended to support the contextual adaptation of undergraduate oncology education in Iran. Their feasibility and implementation may vary according to institutional capacity, faculty availability, clinical resources, and regional health-system conditions.

4- DISCUSSION

This study reviewed the evidence on undergraduate oncology education in Iran, identified curriculum gaps, and proposed a framework for revision informed by international models and local needs. The review found that oncology content is largely fragmented and lacks a longitudinal, competency-based pathway. Key gaps include the absence of an explicit curriculum map, insufficient emphasis on primary care and early diagnosis, limited structured education in supportive and palliative care, unstructured communication-skills training, and the predominance of knowledge-based assessment over performance-based evaluation.

The increasing burden of cancer, particularly in demographically transitioning countries such as Iran, makes strengthening the oncology-related competencies of future general physicians a strategic health-system priority (1, 3, 5, 20). As common first points of contact within the health system, general practitioners play important roles in prevention, screening, recognition of warning signs, risk assessment, initial symptom management, safety-netting, and timely referral (1, 3, 5, 20). However, the available evidence suggests that oncology education in Iran's general medicine program faces fundamental challenges,

including fragmented content, a predominantly disease-oriented approach, and limited alignment between curricular content and the clinical and societal needs of general practice (6, 7, 12–15, 21). Although oncology-related topics are taught across several departments, they often lack an integrated, competency-based, and longitudinal structure—a concern also identified in recent international analyses of undergraduate oncology education (40, 41).

4-1. From Fragmented Delivery to a Longitudinal, Competency-Based Curriculum

The findings of this review indicate that oncology-related topics are commonly delivered in a fragmented manner, with limited interdisciplinary integration across internal medicine, surgery, pediatrics, obstetrics and gynecology, pathology, and radiation oncology (Table 1). This traditional model may lead to repetition of abstract concepts and duplication of theoretical content, while essential competencies for general practice—such as managing diagnostic uncertainty in the early manifestations of cancer and evaluating nonspecific clinical presentations—receive inadequate attention (7, 12, 16).

Evidence from international educational models and medical-education guidance supports the development of a longitudinal and integrated curriculum. In such a

model, biological foundations, cancer genetics, and the pathophysiology of malignancy are introduced during the basic-science phase and progressively linked to clinical semiology, diagnostic reasoning, principles of oncology care, oncologic emergencies, supportive care, and palliative care during clerkship and internship (7–9, 16, 21, 29, 34).

However, international guidance, including frameworks associated with ESMO and ASCO, has generally been developed from specialist and hospital-based perspectives. Therefore, these frameworks should not be directly transferred to undergraduate general-medicine programs without contextual adaptation. Instead, relevant competencies should be selected and adapted according to the expected role of future general practitioners within primary-care and referral systems (Table 2). In this regard, developing a national framework of oncology competencies for general medicine, informed by the concept of Entrustable Professional Activities (EPAs), could help define clear and operational boundaries for the expected scope of competence and supervised clinical responsibility of graduates in the care of patients with suspected or confirmed cancer (40, 42).

4-2. Recalibrating Priorities Toward Primary and Outpatient Care

A major challenge in clinical education at tertiary teaching hospitals is the predominance of complex subspecialty treatment perspectives over the learning needs of undergraduate students. General-medicine students may spend substantial time in inpatient wards, where they are exposed to second- and third-line chemotherapy protocols, management of severe treatment toxicities, and advanced radiotherapy techniques. Although awareness of these issues is useful, detailed mastery of such topics lies

primarily within the scope of oncology specialists and subspecialists.

In contrast, competencies more directly relevant to general practice—including prevention and screening of common cancers, assessment of genetic and environmental risk factors, promotion of health literacy, recognition of warning signs, reduction of diagnostic delay, preliminary evaluation, safety-netting, and appropriate referral—may receive less systematic emphasis (3, 5, 20).

General practitioners should also be able to recognize oncologic emergencies, including acute spinal cord compression, malignancy-associated hypercalcemia, febrile neutropenia, tumor lysis syndrome, and superior vena cava syndrome. Their expected role is to identify potentially life-threatening presentations, initiate appropriate initial stabilization within their scope of practice, and arrange urgent referral to emergency or specialist services to prevent mortality or irreversible complications (8, 9, 20, 21).

Recalibrating curricular priorities requires shifting part of clinical education from inpatient wards in referral hospitals to ambulatory clinics, screening services, comprehensive health-service centers, and family-medicine settings. These settings may better reflect the range of community presentations, opportunities for prevention and early diagnosis, and the actual pathway through which patients with suspected cancer enter the health system (41, 43).

4-3. Institutionalizing Supportive, Palliative, and Survivorship Care

The synthesis identified a substantial gap in the structured teaching of supportive care, cancer-pain management, palliative care, and end-of-life care within undergraduate medical curricula (11, 30). According to international definitions and guidelines, including those of the World Health Organization and ASCO, palliative

care is a multidimensional and continuous approach that should be integrated early in the course of serious illness according to patient and family needs. It should be delivered alongside disease-directed treatment when appropriate and should not be limited to terminal or end-of-life care (11, 30, 31).

Without guided clinical exposure during undergraduate training, future general practitioners may be inadequately prepared to assess and manage common symptoms or to address barriers to appropriate symptom control. These may include concerns regarding opioid prescribing, limited familiarity with opioid conversion principles, and difficulties in managing cancer-related pain, nausea and vomiting, dyspnea, delirium, fatigue, anxiety, and other distressing symptoms (14, 21, 32).

Evidence from international reviews suggests that theoretical instruction alone is unlikely to produce sustained changes in attitudes or clinical competence. Experiential learning, supervised interaction with patients and families, simulation, structured reflection, and guided participation in interdisciplinary palliative-care teams are needed to develop practical and communication-related competencies (44–46).

Advances in cancer treatment and improvements in survival have also increased the need for education in survivorship care. A revised curriculum should prepare graduates to recognize late effects of treatment, identify warning signs of recurrence, provide lifestyle counseling, address psychosocial and supportive-care needs, and coordinate appropriate follow-up and referral (40, 43).

4-4. Contextualizing Communication Skills and Ethical Challenges

Oncology is among the most complex areas of physician–patient communication and ethical decision-making. Although widely used international frameworks,

such as the SPIKES protocol, provide a structured approach to communicating serious news, their implementation should be adapted to the cultural context, family support systems, and religious and spiritual beliefs of the target population (10, 33; Table 3).

In Iran's family-centered sociocultural context, physicians may encounter requests from family members to withhold the diagnosis or prognosis from the patient. Such circumstances may create tension between respect for patient autonomy and the family's perceived supportive role or concern about possible psychological harm (10, 33, 39). Undergraduate education should therefore prepare students to assess patients' information preferences, communicate with empathy, involve families appropriately, manage disagreement respectfully, and balance ethical principles within applicable legal and professional standards.

Teaching these skills through conventional lectures alone is unlikely to be sufficient. Simulation-based education, standardized-patient encounters, and role-play workshops can provide safe and interactive settings in which students practice responding to emotional distress, demonstrating empathy, using therapeutic silence, communicating uncertainty, and negotiating ethically challenging discussions with patients and families (47, 48).

4-5. Active Teaching and Performance-Based Assessment

Achieving undergraduate oncology learning outcomes requires a shift from predominantly one-way content delivery to active and interactive teaching approaches. A blended-learning model may be particularly useful: theoretical foundations can be provided through online or digital learning modules, while face-to-face teaching can focus on case-based learning,

small-group problem-solving, simulation, clinical reasoning, and structured participation in multidisciplinary team or tumor-board meetings (22, 24).

Changes in teaching approaches should be accompanied by reform of the assessment system. Traditional multiple-choice examinations remain useful for evaluating knowledge and clinical reasoning; however, they are insufficient for assessing communication, professional behavior, symptom assessment, teamwork, ethical decision-making, and practical clinical performance. Programmatic assessment and workplace-based assessment (WPBA) can provide a more comprehensive evaluation by gathering evidence from multiple assessment methods and observations over time (25, 35, 36).

Oncology-specific Objective Structured Clinical Examination (OSCE) stations can assess tasks such as recognition of suspected malignancy, explanation of a diagnostic pathway, communication of serious news, symptom assessment, and initial management of oncologic emergencies. Mini-Clinical Evaluation Exercises (Mini-CEX), case-based discussions (CBDs), multisource feedback, reflective logbooks, and direct observation can support workplace-based assessment. Direct Observation of Procedural Skills (DOPS) should be used for defined procedural competencies rather than broadly for all clinical skills (25, 35, 36, 45, 46).

4-6. Implementation Challenges and Structural Barriers

Implementation of these reforms across Iranian medical universities may be constrained by several structural and contextual barriers. These include dense clinical curricula, shortages of trained faculty members and mentors in interdisciplinary areas—particularly palliative medicine—unequal access to clinical-skills and simulation-center

resources across regions, high patient volumes, and the dominance of service delivery over educational activities in referral hospitals (12–15, 21, 39).

Potential strategies include structured faculty-development programs, short interdisciplinary educational modules, national sharing of high-quality digital resources, expanded use of standardized simulation scenarios, and greater use of community-based clinics as teaching settings. These strategies could facilitate implementation while reducing reliance on resource-intensive clinical placements alone (13, 15, 39).

4-7. Strengths and Limitations

A key strength of this study is its integration of Iranian curricular and educational evidence with selected international competency frameworks, teaching approaches, and educational models. This approach enabled the development of a context-sensitive proposal for strengthening undergraduate oncology education in Iran.

However, the findings should be interpreted in light of several limitations. First, as a critical narrative review, the study did not use the formal, reproducible synthesis procedures of a systematic review or meta-analysis. Second, published empirical evaluations of undergraduate oncology education in Iran appear limited, particularly studies assessing educational interventions and their outcomes. Third, institutional variation and the hidden curriculum may not be fully captured in published documents. Finally, the proposed framework requires validation through stakeholder consultation, pilot implementation, and formal evaluation across diverse medical schools and clinical settings (17–19).

4-8. Policy Implications and Implementation Priorities

The findings support the following priorities for curriculum reform:

- **Develop a national oncology competency framework for general medicine.** Establish a joint committee involving the Council for General Medical Education, oncology and palliative-care representatives, medical-education experts, general practitioners, and other relevant stakeholders to define core graduation competencies and contextually appropriate EPAs (12, 21, 39, 42).
- **Develop a longitudinal curriculum map.** Map learning outcomes across the entire medical curriculum to integrate cancer prevention, screening, pathology, early diagnosis, clinical reasoning, referral, supportive care, palliative care, survivorship care, and communication skills (7, 8, 40).
- **Expand community- and ambulatory-based learning.** Allocate structured clerkship and internship experiences to outpatient clinics, cancer-screening settings, comprehensive health-service centers, and family-medicine clinics, alongside hospital-based oncology exposure (41, 43).
- **Strengthen active teaching approaches.** Combine case-based learning, problem-based learning, simulation, standardized-patient encounters, tumor-board observation, interprofessional education, and digital resources to support progressive competency development.
- **Adopt programmatic and workplace-based assessment.** Develop standardized oncology-specific OSCE stations and integrate Mini-CEX, CBDs, DOPS for relevant procedures, direct observation, reflective logbooks, and multisource feedback across medical schools (25, 35, 45).

5- CONCLUSION

This review indicates that undergraduate oncology education in Iranian medical schools remains fragmented, predominantly hospital- and subspecialty-oriented, and insufficiently aligned with the core competencies required for general practice. Although oncology-related content is distributed across several disciplines, substantial curricular gaps remain in primary prevention, early cancer detection, recognition and initial response to oncologic emergencies, structured supportive and palliative care, survivorship care, and culturally responsive communication skills.

Addressing these gaps requires a transition toward a longitudinal, integrated, and competency-based curriculum. Priority actions include developing a national framework of core oncology competencies and Entrustable Professional Activities (EPAs) appropriate for general practice; establishing curriculum maps that link preclinical cancer biology with clinical, ambulatory, and community-based learning; integrating supportive, palliative, and survivorship care throughout training; using simulation to develop culturally responsive communication skills in complex patient–family situations; and adopting programmatic and workplace-based assessment approaches, including oncology-specific OSCEs, Mini-CEX, case-based discussions, DOPS for relevant procedural skills, direct observation, and multisource feedback.

A context-sensitive curriculum may better prepare future general physicians to promote cancer prevention, recognize warning signs, reduce avoidable diagnostic delays, provide safe initial assessment and stabilization, facilitate timely referral, and support symptom management within Iran's health system. However, the available evidence from Iran remains limited and predominantly descriptive.

Further multicenter mixed-methods research is needed to assess the feasibility, acceptability, implementation, educational effectiveness, and longer-term clinical implications of the proposed reforms.

6- CONFLICT OF INTEREST: None.

7- REFERENCES

1. World Health Organization. Cancer: Key facts. Geneva: World Health Organization; 2024. Available from: <https://www.who.int/news-room/fact-sheets/detail/cancer>.
2. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2024;74(3):229-63.
3. World Health Organization. WHO report on cancer: setting priorities, investing wisely and providing care for all. Geneva: World Health Organization; 2020.
4. Sullivan R, Alatisse OI, Anderson BO, Bhoo-Pathy N, Eniu A, Ilbawi AM, et al. Cancer workforce—a global crisis: a Lancet Oncology Commission. *Lancet Oncol*. 2026;27(3):e120-e35.
5. Rubin G, Berendsen A, Crawford SM, Dommett R, Earle C, Emery J, et al. The expanding role of primary care in cancer control. *Lancet Oncol*. 2015;16(12):1231-72.
6. Cave J, Woolf K, Dacre J, Potts HW, Jones A. Medical student teaching in the UK: how well are newly qualified doctors prepared for their role caring for patients with cancer in hospital? *Br J Cancer*. 2007;97(4):472-8.
7. Mattes MD, Patel KR, Higgins KA. A systematic review of undergraduate medical oncology education and the need for standardized core competencies. *J Cancer Educ*. 2016;31(3):579-86.
8. Dittrich C, Kosty M, Jezdic S, Pyle D, Berardi R, Bergh J, et al. ESMO / ASCO Recommendations for a Global Curriculum in Medical Oncology: Edition 2016. ESMO Open. 2016;1(5):e000097.
9. European Society for Medical Oncology, American Society of Clinical Oncology. ESMO/ASCO Global Curriculum in Medical Oncology: Log Book. Lugano: ESMO Press; 2017.
10. Baile WF, Buckman R, Lenzi R, Glober G, Beale EA, Kudelka AP. SPIKES—A six-step protocol for delivering bad news: application to the patient with cancer. *Oncologist*. 2000;5(4):302-11.
11. World Health Organization. Integrating palliative care and symptom relief into primary health care: a WHO guide for planners, implementers and managers. Geneva: World Health Organization; 2018.
12. Ministry of Health and Medical Education (Iran). Curriculum of Undergraduate Medical Education (Doctor of Medicine). Tehran: Secretariat of the Council for Undergraduate Medical Education; 2018.
13. Mohammadi A, Mortaz Hejri S, Garman P, Mirzazadeh A. Clinical skills education in undergraduate medical curriculum: a national survey in Iran. *BMC Med Educ*. 2021;21(1):456.
14. Forootan M, Baradaran HR, Shiri R, Asghari F. Educational needs of Iranian general practitioners regarding palliative care for cancer patients. *J Cancer Educ*. 2020;35(4):780-6.
15. Shirazi M, Labaf A, Monajemi A, Jalili M. Bedside teaching in clinical medical education: assessing the current state and challenges in Iranian teaching hospitals. *J Adv Med Educ Prof*. 2022;10(2):98-105.
16. Al-Azri M. The role of cancer education in undergraduate medical curriculum: a global perspective. *J Cancer Educ*. 2022;37(5):1289-98.
17. Greenhalgh T, Thorne S, Malterud K. Time to challenge the spurious hierarchy of systematic over narrative reviews? *Eur J Clin Invest*. 2018;48(6):e12931.
18. Baethge C, Goldbeck-Wood S, Mertens S. SANRA—a scale for the quality assessment of narrative review articles. *Res Integr Peer Rev*. 2019;4:5.
19. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the

conduct of narrative synthesis in systematic reviews: a product from the ESRC methods programme. Lancaster: Lancaster University; 2006.

20. World Health Organization. Guide to cancer early diagnosis. Geneva: World Health Organization; 2017.

21. Ahmadi F, Hussin NA, Ismail S, et al. Educational needs on palliative care for cancer patients in Iran: a SWOT analysis. *Indian J Palliat Care*. 2018;24(1):23-9.

22. Dennick R. Twelve tips for incorporating educational theory into teaching practices. *Med Teach*. 2012;34(8):618-24.

23. Lane C, Rollnick S. The use of simulated patients and role-play in communication skills training: a review of the literature to substantiate practice of effective training. *Patient Educ Couns*. 2007;67(1-2):13-20.

24. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of e-learning in medical education. *Acad Med*. 2006;81(3):207-12.

25. Heritage SR, Lynch-Kelly K, Kalvala J, Tulloch R, Devasar A, Harewood J, et al. Medical student perspectives on undergraduate oncology education in the UK. *Clin Oncol (R Coll Radiol)*. 2022;34(8):e355-64.

26. Cufer T, Kosty MP; Curriculum Development Subgroup—ESMO/ASCO Global Curriculum Working Group. ESMO/ASCO Recommendations for a Global Curriculum in Medical Oncology Edition 2023. *ESMO Open*. 2023;8(6):101631.

27. Mason SR, Ling J, Stanciulescu L, Payne C, Paal P, Albu S, et al. From European Association for Palliative Care recommendations to a blended, standardized, free-to-access undergraduate curriculum in palliative medicine: the EDUPALL project. *J Palliat Med*. 2020;23(12):1571-85.

28. Centeno C, Ballesteros M, Carrasco JM, Arantzamendi M. Does palliative care education matter to medical students? The experience of attending an undergraduate course in palliative care. *BMJ Support Palliat Care*. 2016;6(1):128-34.

29. Rahemi Z, Soleimani MA, Allen DH, Seyedfatemi N. The concept of palliative care practice among Iranian general practitioners: a

qualitative study. *Int J Community Based Nurs Midwifery*. 2021;9(4):306-17.

30. Sanders JJ, Temin S, Ghoshal A, et al. Palliative care for patients with cancer: ASCO guideline update. *J Clin Oncol*. 2024;42(19):2340-54.

31. Seifart C, Hofmann M, Bär T, Knorrenschild JR, Seifart U, Rief W. Breaking bad news—what patients consider important: a systematic review on the SPIKES model. *Front Psychol*. 2020;11:574488.

32. Frank JR, Snell L, Sherbino J, editors. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.

33. World Health Organization. Framework for action on interprofessional education and collaborative practice. Geneva: World Health Organization; 2010.

34. Issenberg SB, McGaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Med Teach*. 2005;27(1):10-28.

35. van der Vleuten CP, Schuwirth LW. Assessing professional competence: from methods to programmes. *Med Educ*. 2005;39(3):309-17.

36. Norcini J, Burch V. Workplace-based assessment as an educational tool: AMEE Guide No. 31. *Med Teach*. 2007;29(9):855-71.

37. Creswell JW, Plano Clark VL. Designing and conducting mixed methods research. 3rd ed. Thousand Oaks (CA): SAGE Publications; 2018.

38. O’Cathain A, Murphy E, Nicholl J. Three techniques for integrating data in mixed methods studies. *BMJ*. 2010;341:c4587.

39. Saeidi M, et al. Undergraduate oncology education in general medicine: gaps, global models, and contextual adaptation. *BMC Med Educ*. 2026;26(1):112-25.

40. Theros JS, Fuchs JW, Nunes D, Fuchs JR, Mohindra NA. Advances and gaps in undergraduate medical oncology education: a scoping review (2004–2022). *Discover Educ*. 2025;4(1):500.

41. Mattes MD, Patel KR, Maguire PD, et al. A nationwide medical student assessment of oncology education. *J Cancer Educ.* 2016;31(4):679-686.
42. Verma V, Simone CB 2nd, Krishnan S. Competency-based workforce development and education in oncology. *JCO Oncol Pract.* 2023;19(11):980-988.
43. Barton DL, Stavas MJ, Sloan JA, et al. Medical student knowledge of oncology and related disciplines: a pilot needs assessment. *J Cancer Educ.* 2018;33(2):412-417.
44. Walker S, Gibbins J, Barclay S, Adams A, Paes P, Wee B. How effective is undergraduate palliative care teaching for medical students? A systematic review. *BMJ Support Palliat Care.* 2020;10(2):145-152.
45. Fitzpatrick D, Heah R, Patten S, Ward H. Medical undergraduate palliative care education (UPCE): curricular innovations for medical students in palliative and end-of-life care—a systematic review. *BMJ Support Palliat Care.* 2021;11(1):4-11.
46. Pieters J, Dolmans DH, Verstegen DM, Warmenhoven FC, Courtens AM, van den Beuken-van Everdingen MH. Palliative care in undergraduate medical education—how far have we come? A systematic review. *Palliat Med.* 2019;33(3):261-272.
47. Schildmann E, Härter M, Bausewein C. Teaching medical students how to break bad news with standardized patients. *J Cancer Educ.* 2012;27(1):95-101.
48. Reed S, Kassis K, Nagel R, Verbeck N, Mahan JD, Shell R. Breaking bad news: a small-group session teaching the six-step protocol. *MedEdPORTAL.* 2015;11:10057.