



# Research Progress in Competency-Based Teaching and Assessment Strategies in Standardized Residency Training

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## Keywords

competency-based medical education; residency training; workplace-based assessment; OSCE; mini-CEX; clinical competence

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## Abstract

**Background:** As healthcare shifts from a biomedical to a biopsychosocial model, Chinese residency training faces increasing demands to prepare physicians who are not only knowledgeable but also competent in clinical reasoning, communication, teamwork, professionalism, and systems-based practice. Competency-based medical education (CBME) has emerged as a key framework to meet these needs, yet its implementation in China remains variable. **Methods:** This narrative review synthesizes the conceptual foundations and frameworks of CBME in residency training, summarizes commonly used competency-oriented teaching strategies and assessment tools, and analyzes current challenges and potential strategies for implementation in Chinese residency programs. Relevant international and domestic literature on CBME, residency education, and assessment was examined. **Results:** International frameworks such as the Accreditation Council for Graduate Medical Education (ACGME) core competencies and the Canadian Medical Education Directives for Specialists (CanMEDS) roles have informed emerging Chinese competency models. Competency-oriented approaches, including case- and problem-based learning, flipped and blended learning, simulation and standardized patient (SP) encounters, and multidisciplinary team-based activities, are used to support core competency development. Assessment methods such as the Objective Structured Clinical Examination (OSCE), workplace-based assessments including the mini-Clinical Evaluation Exercise (mini-CEX), Direct Observation of Procedural Skills (DOPS), 360-degree evaluations, and learning portfolios enable more multidimensional and longitudinal evaluation. Persistent barriers include incomplete alignment between frameworks and practice, limited faculty development, heavy service workloads, and underdeveloped quality assurance systems. **Conclusions:** Advancing CBME in Chinese residency training will require contextualizing and operationalizing competency frameworks, strengthening faculty capacity as educators and coaches, selecting and phasing in assessment tools in a feasible manner, and building data-informed quality assurance systems supported by information technology. Coordinated efforts at policy, institutional, and clinical teaching levels are needed to develop a sustainable CBME model that supports high-quality healthcare delivery.

## Introduction

As healthcare has evolved from a traditional biomedical model toward a biopsychosocial model, expectations for physicians have expanded from mastery of medical knowledge alone to comprehensive competence in clinical reasoning, communication, teamwork, professionalism, and systems-based practice [1,2]. Traditional medical education, which emphasizes knowledge memorization and written examinations, is increasingly recognized as insufficient to prepare physicians for the complexity and uncertainty of real-world clinical practice [3].

Standardized residency training in China represents a pivotal transition between undergraduate medical education and independent clinical practice [4]. It is during this stage that trainees are expected to consolidate foundational knowledge, acquire core clinical skills, develop sound clinical

reasoning, and internalize professional values. The quality of residency training therefore has direct implications for patient safety and the overall performance of the healthcare system [5]. Competency-based medical education (CBME) has emerged internationally as a key paradigm to address these demands. CBME is oriented around clearly defined outcomes that specify what learners should be able to do in practice. These outcomes are used to guide curriculum design, instructional strategies, and assessment methods [6]. Internationally, frameworks such as the Accreditation Council for Graduate Medical Education (ACGME) six core competencies and the CanMEDS roles have been widely adopted to structure residency training [7]. In recent years, Chinese professional bodies have also begun to formulate core competency frameworks for residents and to incorporate competency-based language into national residency training standards [8].

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However, the transition from traditional training models to CBME remains challenging in practice [9]. In many training bases, educational goals have not been fully translated into concrete teaching activities and assessment processes. Clinical teachers may be unfamiliar with CBME concepts and tools, and quality assurance mechanisms for competency-based training are still under development [10]. In this context, it is timely to synthesize current evidence and experiences regarding competency-based teaching and assessment strategies in residency training. This narrative review aims to provide an overview of the conceptual foundations and frameworks of CBME in residency training, to summarize commonly used competency-oriented teaching strategies, to review key assessment tools and quality control approaches, and to discuss the challenges and potential solutions associated with implementing CBME in Chinese residency programs.

### **Competency-Based Medical Education and Frameworks in Residency Training**

CBME is an outcomes-oriented approach that shifts the focus of medical training from time spent and content coverage to the actual abilities learners demonstrate in clinical practice [11]. Within this paradigm, clearly defined, observable, and measurable competencies form the foundation for curriculum development, instructional methods, assessment strategies, and decisions regarding learner progression.

The ACGME introduced six core competencies for graduate medical education: patient care, medical knowledge, interpersonal and communication skills, practice-based learning and improvement, systems-based practice, and professionalism [12]. These competencies have been further operationalized through the development of milestones, which describe progressive stages of performance from novice to proficiency across different levels of training [13]. Similarly, the CanMEDS framework, developed by the Royal College of Physicians and Surgeons of Canada, conceptualizes the physician as a medical expert who also assumes roles as communicator, collaborator, leader, health advocate, scholar, and professional. Both frameworks emphasize that true clinical competence involves the integration of knowledge, skills, and attitudes across multiple domains, rather than excellence in cognitive knowledge alone [14].

In China, standardized residency training has expanded rapidly under national policy initiatives [15]. Drawing on international experience and responding to local needs, both national and regional authorities have begun to construct competency frameworks tailored for Chinese residents. These often emphasize domains such as professional knowledge and clinical skills, clinical reasoning and decision-making, communication and teamwork, professionalism and patient safety, as well as lifelong learning and self-reflection [16]. While these domains broadly align with international models, they are also shaped by the unique characteristics of the Chinese healthcare system, including high patient volumes, limited resources, and culturally specific expectations.

A well-defined and context-appropriate competency framework is essential for the effective implementation of CBME [17,18]. It offers a shared language for educators, learners, and regulators, and serves as a blueprint for designing learning experiences and assessment systems. However, the mere inclusion of broad competency categories in training manuals is insufficient [19]. Competency domains must be

broken down into specific, observable behaviors that correspond to different stages of training and clinical settings. Only when educational goals are explicit and behaviorally defined can teaching activities and assessment methods be systematically aligned with those goals [20].

### **Competency-Based Teaching Strategies in Residency Training**

Competency-oriented teaching strategies are characterized by their alignment with defined learning outcomes, their emphasis on active learning, and their close integration with clinical practice [21]. In residency training, several approaches are commonly used to promote the development of multiple competency domains.

#### **Case and Problem-Based Learning**

Problem-based learning (PBL) and case-based learning (CBL) are classic approaches for cultivating clinical reasoning and problem-solving skills [22]. Both use clinical cases as the central vehicle for learning. However, PBL typically begins with open-ended problems that are explored and framed by learners, whereas CBL generally employs more structured cases within a defined content area that is selected by teachers [23].

Within a competency-based framework, PBL and CBL are not simply alternative formats for presenting knowledge. Instead, they are deliberately designed to target specific competency domains [24]. For example, a PBL session on acute chest pain may aim for residents to conduct a focused history and physical examination, generate and prioritize differential diagnoses, interpret key investigations, justify management plans based on clinical guidelines and evidence, and communicate clearly within the healthcare team [25]. During these processes, residents are encouraged to articulate their reasoning, identify knowledge gaps, and collaborate in seeking solutions, while faculty members act as facilitators rather than didactic lecturers.

Compared with traditional didactic lectures, PBL and CBL can more effectively foster the integration of knowledge with real clinical problems, promote higher-order thinking, and support the development of communication and teamwork skills [26,27]. Successful implementation, however, depends on careful case design, skilled small-group facilitation, and adequate time allocation within the constraints of busy clinical schedules.

#### **Flipped Classroom and Blended Learning**

The flipped classroom model restructures learning activities by moving initial exposure to new content outside the classroom, for example through pre-recorded videos, e-modules, or assigned readings, and using in-person time for interactive problem-solving, application, and feedback [28]. For residents, who are adult learners with substantial baseline knowledge and irregular schedules, this model can be particularly beneficial.

In competency-based residency training, flipped and blended learning, which combine online and face-to-face activities, can be used to free classroom time for tasks that more directly support competency development [29]. Before a session, residents may review concise videos on updated clinical guidelines, diagnostic algorithms, or procedural steps, accompanied by short quizzes to check understanding. Classroom time can then be devoted to complex case discussions, role plays such as breaking bad news, or simulation-based scenario debriefings that focus on clinical reasoning, communication, and interprofessional collaboration [30].

The educator role shifts from “content provider” to “learning facilitator,” who designs meaningful interactive tasks, provides targeted feedback, and connects learning activities to real clinical challenges [31]. When adequately supported by institutional infrastructure, blended learning can increase flexibility, enhance engagement, and create more opportunities for deliberate practice of competencies that extend beyond factual knowledge.

### Simulation and Standardized Patients

Simulation-based education and standardized patients (SPs) have become important components of residency training, especially for high-stakes procedural skills and sensitive communication tasks. Simulation modalities range from task trainers and manikins to high-fidelity simulators and computer-based scenarios [32]. SPs are trained individuals who consistently portray patients with specific conditions and psychosocial contexts.

From a competency perspective, simulation provides a safe and controlled environment in which residents can repeatedly practice procedural skills, crisis management, and team coordination without putting real patients at risk [33]. Scenarios can be designed to target specific competencies such as early recognition of clinical deterioration, adherence to resuscitation protocols, leadership in emergency situations, and effective interprofessional communication [34]. Structured debriefing after simulations enables reflection, feedback, and consolidation of learning.

SP-based encounters are particularly valuable for training and assessing interpersonal and communication skills, patient-centered care, and professionalism. Scenarios may involve delivering bad news, obtaining informed consent, addressing complaints, or managing conflicts [35]. Residents can receive feedback not only from faculty but also from SPs, which offers additional insight into patients’ perspectives.

Despite these advantages, simulation and SP programs require significant resources, including dedicated space, equipment, and trained faculty and SPs [36]. In many Chinese hospitals, limited funding and high clinical workloads constrain the scale and frequency of simulation activities. Strategic prioritization, focusing on high-risk and low-frequency scenarios in which simulation yields the greatest benefit, may be a pragmatic starting point.

### Multidisciplinary and Team-Based Learning

Multidisciplinary teaching and team-based learning (TBL) both emphasize collaboration across specialties and professions, reflecting the real-world trend toward integrated care for complex conditions such as heart failure, chronic kidney disease, rheumatic diseases, and cancer [37]. In TBL, learners work in stable teams and typically move through phases of individual preparation, readiness assurance testing, and application exercises.

For residents, multidisciplinary teaching can be implemented through joint case conferences, multidisciplinary ward rounds, tumor boards, and chronic disease management clinics [38]. In these settings, residents are encouraged to consider not only their own specialty’s viewpoint but also surgical, imaging, nursing, rehabilitation, and social perspectives. Such learning experiences can explicitly target competencies in systems-based practice, interprofessional collaboration, and comprehensive patient management.

When thoughtfully organized, team-based approaches can

deepen residents understanding of disease complexity, help them appreciate the roles and contributions of different team members, and promote shared decision-making with patients and families [39]. Challenges include coordinating schedules across departments, ensuring meaningful roles for residents, and balancing educational objectives with clinical service demands.

### Competency-Based Assessment Tools and Quality Assurance

Competency-based assessment seeks to answer not only “what residents know” but also “what they can do” and “how they behave” in clinical settings. It therefore relies on multiple tools and data sources, with an emphasis on direct observation, repeated sampling across different contexts, and constructive feedback..

### Objective Structured Clinical Examination (OSCE)

The Objective Structured Clinical Examination (OSCE) is a well-established method for assessing clinical competencies in a structured and standardized manner. Candidates rotate through a series of stations where they are required to complete specific tasks such as history-taking, focused physical examination, interpretation of investigations, performance of procedural skills, or patient counseling [40]. Each station is built on predefined checklists and global rating scales, and may use SPs or simulation models.

In residency training, OSCEs can be used as formative assessments during specific rotations or as summative examinations at key progression points, such as annual evaluations or exit examinations [41]. They are particularly well suited to assessing discrete skills, communication abilities, and selected aspects of professionalism under controlled conditions.

However, OSCEs are resource-intensive. They require careful blueprinting aligned with competency frameworks, thorough station development and pilot testing, training of examiners and SPs, and dedicated time and space [42]. In settings with limited resources, it may be more feasible to use OSCEs selectively, for example by focusing on essential skills in acute care, patient safety, or high-risk procedures, while relying on other tools for ongoing assessment.

### Workplace-Based Assessment: mini-CEX, DOPS, and 360-Degree Evaluations

Workplace-based assessment (WBA) has become a cornerstone of CBME because it evaluates resident performance in real clinical environments. Among WBA tools, the mini-Clinical Evaluation Exercise (mini-CEX), Direct Observation of Procedural Skills (DOPS), and 360-degree evaluations are widely used in residency programs.

The mini-CEX involves direct observation of a resident conducting a focused clinical encounter, such as a new consultation or follow-up visit, followed by immediate feedback. Faculty assess dimensions such as history-taking, physical examination, clinical judgment, communication, organization, and professionalism using rating scales [43]. Each mini-CEX is brief, usually 10 to 20 minutes, and multiple encounters over time provide a rich picture of a resident performance. DOPS focuses specifically on procedural skills such as venipuncture, central line insertion, urinary catheterization, or joint aspiration. Supervisors observe the resident performing the procedure, evaluate technical and non-technical aspects, including aseptic technique, patient communication, and safety, and provide structured feedback [44,45]. 360-degree evaluations



collect perspectives from colleagues, nurses, other healthcare professionals, and sometimes patients. They can be especially informative for competencies that are difficult to assess through examinations, such as teamwork, reliability, and professional behavior [46].

Workplace-based assessment tools align closely with CBME principles because they are embedded in daily clinical work, capture performance in authentic contexts, and emphasize formative feedback. However, their effectiveness depends heavily on faculty engagement and training. Without adequate support, WBAs can degenerate into superficial form-filling exercises. Institutions must set realistic expectations regarding the number of assessments, allocate time for observation and feedback, and provide faculty development that helps supervisors use WBA tools for coaching and learner development rather than for mere policing.

### Learning Portfolios and Information Technology

Learning portfolios are collections of evidence that document a resident's learning experiences, reflections, achievements, and feedback over time. Portfolio contents may include logbooks of procedures and cases, assessment forms, reflective essays, teaching activities, quality improvement projects, and scholarly work [47]. Portfolios support longitudinal tracking of competency development and encourage both self-assessment and reflective practice.

In CBME systems, portfolios can serve as a central repository for diverse assessment data and as the basis for regular progress reviews with mentors. They can also inform decisions about readiness for increased responsibility and eventual certification [48]. Information technology plays an increasingly important role in supporting competency-based assessment and quality assurance. Electronic residency management systems can integrate WBA forms, OSCE results, portfolio uploads, and attendance records. Automated dashboards can provide visual summaries of resident progress across competencies, highlight areas that require remediation, and identify systemic gaps in training opportunities [49]. For educators and program directors, these data facilitate program evaluation and continuous quality improvement.

To fully realize these benefits, training bases need to invest in user-friendly systems, ensure data security, and provide adequate training and support for both faculty and residents. Overly complex platforms or excessive documentation requirements may inadvertently increase administrative burden and reduce meaningful engagement with assessment processes [50].

### Challenges and Strategies for Implementing CBME in Chinese Residency Training

Despite growing consensus on the value of CBME, its implementation in Chinese residency programs remains uneven, and several common challenges can be identified. First, alignment between competency frameworks and training processes is often incomplete. Although policy documents and training standards may list competency domains and learning objectives, rotational arrangements, daily teaching activities, and assessment forms may still focus primarily on case numbers, service workload, and examination scores [51]. In such situations, competencies remain abstract labels rather than concrete guides for curriculum design and evaluation. Second, many clinical teachers have limited exposure to educational theory and CBME methods, and their teaching practices are grounded mainly in personal clinical experience and apprenticeship models [52]. Without systematic

faculty development, expectations to implement PBL, flipped classrooms, mini-CEX, or DOPS can be perceived as additional burdens rather than opportunities to enhance teaching, leading to low motivation or mechanical implementation [53]. Third, heavy clinical workloads and staffing constraints pose practical barriers. In busy departments, it is difficult for supervisors to devote time to repeated direct observation and feedback, detailed documentation, or sophisticated OSCEs [54]. As a result, assessment tools may be completed hastily, with minimal feedback, which undermines their educational value. Fourth, institutional systems and incentives for teaching are still evolving. In some hospitals, teaching contributions carry limited weight in promotion and performance appraisal compared with service productivity and research output [55]. This weakens the incentive for faculty to invest in time-consuming educational activities and innovation, and at the program level, systematic mechanisms for data-driven quality assurance and continuous improvement may be lacking.

To address these challenges, several complementary strategies can be considered. Strengthening top-down design and integration is essential. Training bases should refine national or regional competency frameworks into phase-specific and rotation-specific behavioral expectations, and these expectations should be explicitly linked to curriculum content, teaching plans, and assessment tools [56]. Exit examinations and graduation decisions need to reflect demonstrated competence rather than only time served or written test scores. At the same time, developing faculty as educators and coaches is a critical priority. Structured faculty development programs, including workshops and ongoing support, can help clinical teachers understand CBME concepts, practice facilitating active learning, and learn how to use WBA tools to provide constructive feedback [57]. Identifying and supporting a core group of "educational champions" in each department can create local leadership and foster peer mentoring around educational practice.

Rational selection and phased implementation of assessment tools can also improve feasibility and acceptance. Rather than adopting many tools simultaneously, programs can start with a small number of high-yield methods, such as mini-CEX and DOPS in selected rotations, integrated into existing ward rounds or procedural supervision [58]. As experience grows and evidence of benefit accumulates, the scope can gradually be expanded. Leveraging information technology to reduce burden and enhance feedback is another important strategy. Digitizing assessment forms and integrating them into mobile or web-based platforms can streamline data entry and retrieval, while automated aggregation and visualization of results can make it easier for faculty and residents to track progress. Templates and checklists can help standardize feedback while saving time [59]. Finally, embedding teaching and assessment within institutional performance systems is crucial. Hospitals and training bases should explicitly recognize and reward educational work in job descriptions, promotion criteria, and performance evaluations [52]. Excellence in teaching and contributions to competency-based curriculum development and assessment should be acknowledged alongside clinical and research achievements, thereby fostering a culture that values education as a core mission.

### Conclusions and Future Directions

Competency-based medical education provides a practical framework for aligning residency training with the real demands of clinical practice. By defining clear outcomes and organizing

curricula, teaching, and assessment around them, CBME aims to ensure that residents can deliver safe, effective, and patient-centered care rather than simply perform well on knowledge tests.

In China, standardized residency training has expanded and competency language is increasingly embedded in policies, but implementation of CBME remains at an early and uneven stage. Future priorities include contextualizing and operationalizing competency frameworks, strengthening faculty capacity as educators and coaches, using assessment tools in a focused and feasible way, and building data-informed quality assurance systems supported by information technology. Through coordinated action at policy, institutional, and clinical teaching levels, a sustainable CBME model for residency training in China can gradually be established.

### Conflict of Interest

There is no conflict of interest.

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