

Research on the Current Status and Future Governance Strategies of Mini-CEX in Standardized Resident Physician Training

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Abstract: As a crucial assessment tool, the Mini Clinical Evaluation Exercise (Mini-CEX) has gradually garnered attention in the clinical skills training of resident physicians. With the ongoing advancement of medical education reform, Mini-CEX not only offers a fresh perspective for evaluating the clinical competence of resident physicians but also establishes a foundation for enhancing their overall quality and professional capabilities. Nonetheless, there are still certain constraints in the application of Mini-CEX, including inconsistent assessment criteria, assessor subjectivity, and inadequate feedback mechanisms. This paper will review relevant domestic and international studies, explore the practical application of Mini-CEX in standardized resident physician training, analyze its strengths and weaknesses in assessing clinical ability, and propose recommendations for future development directions. Through a thorough examination of this field, it aims to provide references and guidance for further optimizing the training model for resident physicians.

Keywords: Mini-CEX; Resident physicians; Standardized training; Medical education

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1. Introduction

The standardized training for resident physicians is crucial for enhancing their professional competence and clinical skills, with effective evaluation being the linchpin. The Mini Clinical Evaluation Exercise (Mini-CEX) serves as a tool to assess resident physicians' clinical performance and skills, providing evaluations and feedback through direct observation of their performance in clinical settings^[1-3]. The implementation of Mini-CEX fosters positive interactions between residents and their mentors, enhancing the learning experience and satisfaction^[4]. However, challenges such as faculty training and scheduling persist in implementing Mini-CEX, potentially affecting the quality and effectiveness of the evaluations^[3,5]. With the advancement of medical education, Mini-CEX is increasingly being applied in resident training. Studies indicate that it can be combined

with other assessment tools like OSCE to achieve a more comprehensive evaluation of competencies ^[6]. This integration enhances the effectiveness of assessments and promotes residents' comprehensive abilities in various clinical scenarios. Additionally, Mini-CEX has been widely recognized and demonstrated significant application effects across multiple specialties, including emergency medicine, internal medicine, and surgery ^[7,8]. Mini-CEX is expected to play a more significant role in medical education, becoming a pivotal component of resident training. As an assessment tool, Mini-CEX holds significant application value in resident training. This paper will provide an in-depth analysis of the background, concept, and application of Mini-CEX in training, as well as an outlook on its development trends. Our aim is to offer references for medical education reform through the study of Mini-CEX.

2. Definition and characteristics of Mini-CEX

2.1. Origins, theoretical basis and implementation framework of Mini-CEX

Mini-CEX originated in the 1980s to 1990s with the aim of more effectively evaluating physicians' clinical competence. The American Board of Internal Medicine (ABIM) developed this assessment tool to enhance the practicality and effectiveness of evaluations while strengthening interactions and feedback between educators and medical students. As a direct observation assessment tool, Mini-CEX is used to evaluate medical trainees' professional skills in clinical settings, encompassing data collection, communication, diagnosis, and management planning ^[9]. The implementation of the Mini-Clinical Evaluation Exercise (Mini-CEX) provides learners with immediate feedback and helps instructors gauge learning progress and capabilities. This tool has been widely used across different cultural and educational contexts, with its effectiveness and reliability confirmed by research ^[10]. Mini-CEX is suitable for clinical settings, such as emergency departments, but its effectiveness and acceptability require further study ^[11].

2.2. Evaluation indicators of Mini-CEX

The evaluation indicators of Mini-CEX cover multiple dimensions, primarily including validity, reliability, educational impact, acceptability, and cost-effectiveness. Research has shown that Mini-CEX demonstrates high validity and reliability in assessing learners' clinical abilities, with Cronbach's alpha values typically ranging from 0.58 to 0.97, indicating good internal consistency ^[10]. Mini-CEX can distinguish between learner levels and has an educational impact on the assessment of clinical skills. The quality and timeliness of feedback are crucial to its effectiveness, but uneven quality often raises questions ^[11]. In terms of acceptability, although learners and instructors generally hold a positive attitude towards Mini-CEX, it still faces challenges such as time constraints, resource limitations, and subjectivity in practical applications ^[12].

2.3. Implementation process of Mini-CEX

The implementation process of Mini-CEX typically involves several key steps. First, instructors need to undergo relevant training to familiarize themselves with the evaluation criteria and feedback mechanisms of Mini-CEX ^[12]. Second, in a clinical setting, instructors directly observe learners and assess their performance in specific situations. During the evaluation process, instructors use a standardized Mini-CEX evaluation form to record learners' performance and provide timely feedback afterward to help learners recognize their strengths and weaknesses ^[13]. Finally, instructors and learners can jointly review the evaluation results to develop subsequent learning and improvement plans. Research has shown that Mini-CEX can be effectively implemented in various clinical settings, but instructor engagement and time management may affect its

implementation effectiveness^[9]. Through this structured evaluation approach, Mini-CEX not only enhances trainees' clinical skills but also strengthens the interaction between trainees and instructors, thereby promoting improved learning outcomes. During implementation, clinical scenarios are selected to allow residents to interact with patients, while observers record their performance and engage in feedback discussions. Mini-CEX evaluates clinical competence, boosts confidence, facilitates career development, improves doctor-patient communication, and enhances the quality of medical services.

3. Current status of Mini-CEX in standardized resident training

3.1. Comparison of application status at home and abroad

In recent years, Mini-CEX has been widely adopted in resident training programs, becoming an integral part of educational assessment standards in North America and Europe. Many medical education institutions utilize Mini-CEX as a formative assessment tool, providing immediate feedback and guidance. For instance, in internal medicine resident programs in the United States, Mini-CEX is employed to evaluate residents' clinical performance, with research demonstrating significant improvements in their clinical skills^[3].

In contrast, the application of Mini-CEX in China started relatively late but has gradually gained attention in recent years. Some hospitals and medical schools have begun to introduce Mini-CEX into resident training programs, particularly in surgical and internal medicine fields. Preliminary studies indicate that this assessment method can effectively enhance residents' clinical abilities and self-confidence^[14]. Currently, the application of Mini-CEX in standardized resident training programs in China is extremely widespread, covering multiple specialty areas including pediatrics, emergency medicine, critical care medicine, anesthesiology, and more. Its implementation methods also exhibit a high degree of flexibility and diversity, not limited to real clinical environments but also incorporating simulated teaching, scenario-based simulations, and other forms. Furthermore, the combined use of Mini-CEX with other assessment tools such as DOPS (Direct Observation of Procedural Skills) has been proven to significantly enhance the training effectiveness of clinical procedural skills. Despite the increasing number of application cases of Mini-CEX in China, there is still a significant gap in its promotion compared to foreign countries. There is an urgent need for more empirical research and policy support to facilitate the widespread adoption of Mini-CEX in China.

3.2. Applicability of Mini-CEX in different departments

The application of Mini-CEX in clinical departments exhibits variations. Core departments such as internal medicine, surgery, and obstetrics and gynecology extensively utilize it to evaluate the clinical skills and professional competencies of residents. Studies have shown that in the training of obstetrics and gynecology residents, Mini-CEX can effectively assess their progress in terms of ACGME milestones and EPAs^[1]. Additionally, in the field of emergency medicine, despite the challenge of insufficient time due to busy clinical workloads, Mini-CEX has proven to be an acceptable assessment tool^[15]. In family medicine, the combined use of Mini-CEX and DOPS has demonstrated a positive impact on enhancing residents' clinical abilities and knowledge levels^[7].

A study on the assessment of anesthesiologists' clinical skills using Mini-CEX revealed that, compared to the control group, the intervention group using Mini-CEX showed a more significant improvement in clinical skills. Trainees generally accepted the immediate feedback received in real clinical settings, and this immediate feedback mechanism enabled trainees to effectively identify their strengths and weaknesses, thereby enhancing their learning experience. In another study assessing residents' physical examination skills using

Mini-CEX, after multiple assessments, trainees' scores in physical examination skills significantly increased from an average of 2.67 to 6.57, indicating that Mini-CEX may provide a more effective framework for skill development compared to previous assessment tools. These research findings suggest that Mini-CEX has strong applicability across various departments; however, its implementation effectiveness is influenced by departmental characteristics and clinical environments, necessitating adjustments and optimizations based on specific circumstances.

3.3. Practical feedback and experience summary of Mini-CEX

During the implementation of Mini-CEX, feedback from residents and supervisors has provided valuable practical experience. Many residents have indicated that the immediate feedback mechanism of Mini-CEX enables them to quickly identify their shortcomings and make improvements in their next clinical practice ^[16]. For instance, in surgical training, residents generally report significant improvements in clinical consultations, physical examinations, and professional competence through Mini-CEX assessments ^[4]. However, some residents have noted that the relatively short assessment duration and the associated pressure may affect their performance, suggesting that when implementing Mini-CEX, it is crucial to arrange assessment times reasonably to ensure both the effectiveness of the evaluation and the psychological comfort of the residents. Additionally, instructors generally find that Mini-CEX facilitates teaching interactions but also emphasize the importance of instructors' familiarity with and training in using the tool ^[6]. Overall, Mini-CEX shows promising application prospects in resident training, though continuous adjustments are necessary in practice to accommodate the needs and characteristics of different departments.

4. Analysis of the effectiveness of Mini-CEX

4.1. Accuracy in clinical skills assessment

Studies have shown that Mini-CEX demonstrates high accuracy and reliability in assessing the clinical skills of medical students. For example, a study involving 199 medical students revealed significant improvements in their performance across four domains, including data collection, communication, diagnosis, and management planning, after undergoing Mini-CEX assessments ^[12]. Furthermore, the implementation of Mini-CEX enhances interactions between instructors and students, and the feedback process aids in skill development, thereby strengthening the effectiveness of the assessment ^[5]. However, the accuracy of the assessment is also influenced by the training and experience of the assessors, necessitating regular training for assessors to ensure consistency and fairness in evaluations ^[11].

4.2. Self-reflection and acceptance of Mini-CEX

Mini-CEX is not only an assessment tool but also promotes self-reflection among residents. Through direct observation and feedback, residents can gain a clearer understanding of their strengths and weaknesses in clinical practice, thereby motivating them to learn and improve themselves. A study found that 61% of resident physicians reported that the use of Mini-CEX enhanced their motivation to learn and facilitated their progress in clinical skills ^[13]. This reflective process not only improved their clinical skills but also boosted their self-confidence and professional identity ^[17].

Additionally, after undergoing Mini-CEX evaluations, resident physicians often actively sought more feedback and guidance, and this proactive learning attitude further promoted their professional growth ^[3].

Surveys have shown that both educators and resident physicians generally hold positive views on Mini-

CEX, with an overall high level of acceptance, although some differences exist. One survey indicated that teacher and student satisfaction with Mini-CEX reached 95.0% and 92.5%, respectively. Resident physicians showed a higher level of approval for this assessment method, with many stating that Mini-CEX provided them with targeted feedback, which helped them identify their strengths and weaknesses and subsequently enhance their clinical skills and professional competence. Observers, on the other hand, tended to be more cautious in their evaluations, partly due to the complexity of the assessment criteria and implementation process.

4.3. Correlation between learning outcomes and clinical practice

There is a close correlation between the learning outcomes of Mini-CEX and clinical practice. Through this form of assessment, resident physicians can apply their learned knowledge and skills in real clinical settings, effectively integrating theory with practice. Research has shown that resident physicians participating in Mini-CEX have improved in all aspects of clinical skills, particularly in their ability to gather medical histories and conduct physical examinations ^[18]. Furthermore, Mini-CEX is not limited to assessing a single skill; it can also comprehensively evaluate resident physicians' communication skills, clinical judgment, and decision-making abilities, all of which are essential elements in clinical practice ^[11]. Therefore, as a dynamic assessment tool, Mini-CEX can effectively reflect the learning outcomes of resident physicians in clinical practice and lay the foundation for their future career development ^[5].

5. Limitations and challenges of Mini-CEX

5.1. Subjectivity in peer assessment

Mini-CEX has been widely used in clinical education, its subjectivity remains a significant limitation. Differences in the assessors' personal experiences, professional backgrounds, and interpretations of assessment criteria may lead to varying scores for the same student's performance. This subjectivity not only affects the reliability of the assessment but may also impact students' learning motivation and confidence. For instance, a study on surgical interns revealed that students perceived a lack of teacher support and involvement in the implementation of Mini-CEX, leading to reduced trust in the assessment results ^[9]. Additionally, many students mentioned in their feedback that assessors' scores sometimes appeared arbitrary and lacked consistency, further exacerbating doubts about the assessment outcomes ^[12]. Therefore, enhancing the objectivity of the assessment and reducing the influence of subjective factors pose a major challenge in the widespread adoption of Mini-CEX.

5.2. Time and resource consumption in implementation

Given the limited teaching resources, how to allocate time reasonably to ensure that every student receives thorough evaluation has become a significant issue faced by medical education institutions. Moreover, when conducting Mini-CEX assessments, teachers not only need to spend time observing and scoring but also providing feedback. This further increases the workload of teachers, and the heavy clinical workload exacerbates this conflict ^[3]. Therefore, optimizing the implementation process of Mini-CEX and improving the efficiency of assessments have become urgent challenges to address.

5.3. Training needs for trainers

Implementing Mini-CEX not only requires assessors to possess solid clinical knowledge and observation skills but also necessitates their mastery of effective feedback techniques. However, many educational institutions

currently invest insufficiently in training assessors, resulting in a lack of necessary skills and confidence among assessors when using Mini-CEX. One study points out that although 94.4% of teachers believe that Mini-CEX can improve teacher-student interaction, only 27.1% of students think that teachers' participation and support are adequate ^[12]. Additionally, teachers need to continuously update their knowledge and skills during the assessment process to adapt to the ever-changing healthcare environment and educational needs. Therefore, the establishment of regular training and assessor support systems is particularly crucial to ensure the effective implementation and optimal functioning of Mini-CEX ^[9].

6. Future development directions of Mini-CEX

6.1. Integration with other assessment tools

One of the future development directions of Mini-CEX is its integration with other assessment tools. Research indicates that Mini-CEX can be combined with other assessment methods, such as Direct Observation (DO), Objective Structured Assessment of Technical Skills (OSATS), and Case-Based Discussion (CBD), to form a more comprehensive assessment system. This integration can better evaluate clinical competencies in medical education, particularly in complex clinical settings ^[19]. By integrating different assessment tools, multidimensional competency evaluations can be achieved, providing students with timely feedback in various clinical scenarios and thereby facilitating their learning and development. Moreover, integrating with other tools enhances the reliability and validity of assessments, ensuring that students acquire the necessary skills and knowledge in real clinical environments. In the future, effectively integrating Mini-CEX with other assessment tools will be a crucial topic for improving the quality of medical education.

6.2. Prospects for the application of informatization and digitization

With the rapid development of information technology, the digital and information-based application of Mini-CEX holds vast prospects. Digital tools enable real-time data collection and analysis, making the assessment process more efficient and transparent ^[20]. For instance, leveraging mobile applications or online platforms, assessors can more conveniently record observations and generate instant feedback reports. This digital assessment approach not only enhances assessment efficiency but also strengthens data traceability and analytical capabilities. Additionally, with the aid of video recording and playback technology, the Mini-CEX assessment process can be documented for subsequent learning and reflection.

Residents can gain a deeper understanding of their strengths and weaknesses by reviewing their own clinical performances and make improvements accordingly. This method is particularly crucial in some high-risk medical procedures, aiding in enhancing physicians' operational skills and clinical decision-making abilities. The integration of virtual reality and simulation technologies is also a significant development direction. By simulating real clinical scenarios, residents can practice in a risk-free environment while assessors observe and score them in real time. The application of this new technology can effectively enhance residents' clinical responsiveness and communication skills.

6.3. Policy support and standardized development

To promote the effective implementation and development of Mini-CEX, policy support and standardized development are of paramount importance. Governments and medical education institutions should formulate relevant policies to clarify the role and status of Mini-CEX in medical education and encourage its application in various medical training programs ^[21]. Furthermore, establishing a nationwide standardized assessment

framework will enhance the consistency and comparability of Mini-CEX implementation, ensuring that different regions and institutions adhere to the same standards and procedures during the assessment process. Meanwhile, policy support should also encompass training for educators to enhance their ability and confidence in using Mini-CEX for assessment. Through policy guidance and support, Mini-CEX will be better integrated into the medical education system, thereby improving the overall quality of medical education.

7. Conclusion

As an emerging assessment tool for resident physicians, Mini-CEX demonstrates significant potential for application in standardized training programs. It offers structured evaluation and real-time feedback, which aids in enhancing the professional skills of resident physicians. Although studies have shown that Mini-CEX possesses good reliability and validity, its effectiveness and limitations still require in-depth investigation. The implementation outcomes are influenced by factors such as assessor training, the evaluation environment, and individual differences among the residents being assessed.

Future research should focus on the standardization of Mini-CEX, developing unified assessment criteria and training procedures to ensure the objectivity and consistency of evaluation results. Additionally, exploring its integration with other assessment methods can provide a more comprehensive perspective for evaluating the comprehensive abilities of resident physicians. In summary, Mini-CEX holds substantial value in resident physician training. However, to fully leverage its potential, further research and practical exploration are necessary to strengthen its standardization, promote the professional development of resident physicians, enhance their clinical capabilities, and ultimately better serve patients and the healthcare system.

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