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Development of a tool for assessing the clinical competency of Chinese master's nursing students based on the mini-CEX: a Delphi method study

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ABSTRACT

Objective To construct a scientific and systematic competency evaluation tool for master of nursing specialists (MNS) and to provide a reference for the training, assessment and competency evaluation of MNS.

Methods A first draft of the indicators for assessing MNS core competencies was developed on the basis of published research and group discussions. Between June and December 2020, the indicators were revised using two rounds of the Delphi expert consultation method, with questionnaires completed by 16 experts from five provinces in China.

Results The valid retrieval rate of the two questionnaires was 100.00%, and the coefficient of expert authority was 0.931. The Kendall's concordance coefficients of the two rounds of questionnaires were 0.136 ($p<0.05$) and 0.147 ($p<0.05$), respectively. Consensus was reached on the seven dimensions and 52 items of the MNS competency assessment instrument. The instrument dimensions included nurse–patient communication (9 items), health assessment (7 items), clinical decision-making (8 items), operational skills (7 items), health promotion (6 items), humanistic care (9 items) and organisational effectiveness (6 items).

Conclusions The MNS competency assessment tool constructed in this study is focused and highly credible. The findings can be used as a guide for the training, assessment and competence evaluation of MNS in the future.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The mini-clinical evaluation exercise was used as a basis for constructing a corresponding clinical competence evaluation tool for master of nursing specialist.
⇒ The indicators were revised by 16 experts from five provinces in China using the Delphi expert consultation method.
⇒ The instruments developed in this study were not empirically examined due to time constraints.

INTRODUCTION

To meet the needs of nursing talent in order to promote the development of medical careers in China, the system for cultivating highly educated nursing talent should be continuously optimised, and a scientific cultivation model should be built. In January 2010, the Academic Degrees Committee of the State Council reviewed, approved and added master of nursing specialist (MNS) as a qualification.[1] Since then, the number of educational institutions offering an MNS degree has significantly increased, with 122 institutions in China currently offering such a programme.[2] Although the Academic Degrees Committee of the State Council posited that the educational goal is to develop advanced practice nurses (APNs) with a high level of theoretical knowledge and skilled clinical practice competence in a specialised nursing field, each institution's perception of this goal differs, and there are no certified, unified education competence standards to effectively establish competence-based education in MNS degrees.[3] This lack of standards has resulted in inconsistent MNS competence education among institutions.[4]

Many countries have established professional competence frameworks for MNS. For example, Norway developed the Professional Nurse Self-Assessment Scale based on the Nordic advanced practice nursing model, which is extensively used in Europe to evaluate the competence of those with a master's degree in nursing.[5] The Competence Scale for Senior Clinical Nurses was developed based on Japanese national competence requirements.[6] The Advanced Practice Nursing Competency Assessment Instrument was developed to assess the competence of clinical nurses in Spain with a master's degree based on worldwide and multicontextual APN roles and the Spanish Standards for Nursing Practice.[7] Since competence frameworks are designed for practice in specific environments, the direct application of other countries' competence frameworks to Chinese

MNS programmes may not be suitable due to the various differences in cultural, socioeconomic and healthcare systems. Hence, it is necessary to develop a professional competence framework for MNS programmes that will provide clear guidance for MNS education and ensure this quality.

In 1995, the American Board of Internal Medicine (ABIM) developed the mini-clinical evaluation exercise (mini-CEX), which is a teaching and evaluation tool based on traditional clinical exercises.[8] It is called 'mini' because it takes comparatively less time than a conventional case presentation. However, the greater advantage of the mini-CEX is the structured feedback that it provides to students as well as faculty members, which helps them make better decisions.[9] The mini-CEX is a tool that presents a 10–20 min snapshot of doctor/patient interaction. It is designed to assess the clinical skills, attitudes and behaviours of students that are essential for providing high-quality care. This tool was used by more than 20 medical schools in the USA, and studies were conducted with good results; therefore, the ABIM examination was applied to evaluate the clinical skills of interns.[8] The mini-CEX is now widely used and has achieved effective results in many different countries, including the USA[10] and China,[11] and it represents an important way to develop and assess clinical practice skills as good evaluations have been received across medical master's students, resident doctors, new nurses and undergraduate nursing students.[12 13]

Presently, domestic nursing scholars based on the mini-CEX conceptual framework and combined with clinical nursing work standards and clinical experience use a literature review and Delphi expert correspondence to compile the mini-CEX assessment scale, which is widely used in the field of clinical practice competence assessment for nursing trainees, regulatory nurses and new nurses.[14] The assessment mainly includes dimensions such as the following: (1) medical interviews and nursing assessments (interviews, questioning and receiving); (2) nursing examinations and physical examinations; (3) organisational effectiveness; (4) health education and consultation health education; (5) nursing diagnosis and clinical diagnosis; (6) nursing problems; (7) nursing operations and operational skills; (8) humanistic care; (9) overall clinical performance status and competency level; and (10) communication skills (skills) and nurse–patient communication.[14] Liu Y-P *et al*[15] developed a nursing-specific mini-CEX and assessed the core competencies of new nurses in a first-year graduate training programme in Taiwan and[12] verified the impact of the mini-CEX score on the clinical competence of nursing students.

Notably, MNS training should focus on clinical nursing practice competencies, and assessments should focus on clinical practice competencies and the ability to address clinical nursing problems independently.[16] However, analyses of the current clinical competency assessment tools for MNS postgraduates have not been carried out in the areas of clinical decision-making ability and nursing practice ability; therefore, the assessment tools for MNS clinical competency need to be further improved. To this end, based on the mini-CEX theoretical framework, this study used the Delphi expert consultation method to construct corresponding clinical competence evaluation tools for MNS postgraduates to provide a theoretical basis and practical experience for further improving postgraduate student training and assessment programmes.

METHODS

Research group establishment

The research team consisted of 11 researchers, including seven experts in the fields of nursing education and clinical nursing and four master's degree students in nursing. Among them, there was one chief nurse, three deputy chief nurses and three supervising nurses. The seven expert members were mainly responsible for the initial development of the terminology used in the indicator system, the preparation of the expert consultation questionnaire and the selection of correspondence experts, and nursing students. Four postgraduate students were mainly responsible for the distribution and recovery of the indicator questionnaires, the collation of expert opinions and the data analysis.

Development of the expert correspondence questionnaire

Preliminary formation of the correspondence questionnaire

Through an extensive review and search of related literature, a pool of entries of core competency evaluation indices for graduate nursing students was collected. The authors performed a systematic search of databases such as the China National Knowledge Infrastructure, Chongqing VIP, Wanfang Data, China Biology Medicine Disc databases, PubMed and Web of Science, among others, with '((Master of Science in Nursing OR Graduate Nursing Students) AND (clinical competence OR competency, clinical OR competence, clinical OR clinical competency OR clinical competencies OR competencies, clinical OR clinical skill OR skill, clinical OR skills, clinical OR clinical skills OR clinical ability)) AND (Indicator OR system OR index OR indicators OR model OR framework)' as the search formula in the title or abstract fields. The timeframe for the search ranged from the inception of the database to February 2020. Employing the conceptual framework of the mini-CEX as the theoretical guide and through repeated discussions of the subject group, the first draft of the MNS clinical competence evaluation index system was generated, which included seven primary indices and 53 secondary indices (online supplemental appendix I).

Preparation of the expert correspondence questionnaire

The questionnaire mainly consisted of three parts: (1) consulting instructions, which introduced the purpose, meaning and instructions for completion; (2) a questionnaire on the basic information of experts, the basis of experts' judgement and familiarity; and (3) the MNS

core competence evaluation index system questionnaire, which used a 5-point Likert scale to rate the importance of evaluation indices, and a setting that allowed the deletion, addition or modification of columns to invite experts to improve the indices, and the MNS core competency evaluation index system letter form, which used a 5-point Likert scale to rate the importance of the evaluation indices, and a setting that allowed the deletion, addition or modification of columns, and asking experts to improve the indicaPtors.[17]

Delphi expert consultation

The Delphi method is a qualitative research approach used to reach consensus through expert opinion on a real-world problem.[18] The objective of this process is to structure information on a topic about which little is known; the research questions can be answered by a panel of geographically diverse experts.[18] Researchers using this method are able to obtain accurate and reliable data through multiple rounds of queries.[19] The Delphi method is an appropriate choice when the research question requires gathering subjective information from experts and those working in the field,[20] either to set priorities or to reach a consensus where none existed before.[19]

Selection of experts

In this study, a total of 16 experts from medical schools and clinical nursing experts from five provinces, namely Beijing, Zhejiang, Heilongjiang, Sichuan and Chongqing, were identified for correspondence. The inclusion criteria for the correspondence experts were as follows: (1) had a qualification as a postgraduate supervisor for a nursing master's degree programme; (2) had a bachelor's degree or above; (3) had 15 years of experience in corresponding nursing work and/or nursing education; and (4) had rich teaching or research experience in the cultivation of clinical competence among MNS postgraduates.

Implementation of expert consultation

The questionnaires were sent to the experts via two methods, namely Weibo and email, from June to December 2020, and each round of questionnaires lasted for 2 weeks. After each round of consultation, the research team discussed the experts' opinions and revised, deleted or added indicators. The indicators were then selected based on a mean importance assignment >3.50 and a coefficient of variation (Cv) <0.25.[21]

Statistical methods

The data were exported to an Excel file (Microsoft, Redmond, Washington, USA) and analysed with SPSS V.26.0 (IBM) statistical software. The measurement data were expressed as the mean and SD (M±SD), and the count data were expressed as the frequency and percentage. The motivation of experts is demonstrated by the recovery rate of the expert communication form, which, if it exceeds 70%, indicates a high level of participation.[22] The degree of expert opinion coordination, Kendall's harmonious coordination coefficient W and Cv were calculated; the expert authority coefficient (Cr) was calculated by the familiarity of experts with the indices (Cs) and the coefficient of judgement basis (Ca), Cr=(Cs+Ca)/2[21]. Additionally, the concentration of expert opinions was assessed using the mean ± standard deviation (SD) of the importance assigned to each index. P<0.05 was considered to indicate a statistically significant difference.

Patient and public involvement

Neither patients nor the public were involved in the design, conduct, reporting or dissemination of this research.

RESULTS

General expert information

A total of 16 experts participated in the Delphi expert consultation for this study. Most of them were experts with an age distribution of more than 46 years (11, 68.7%) and more than 21 years of work experience (12, 75.0%). Half of the participants had a master's degree or higher (8, 50.0%), and all the experts had a title of associate or higher. In addition, 14 (87.5%) of them were master's degree supervisors, and 2 (12.5%) were doctoral supervisors. Therefore, the experts involved in the consultation had extensive experience in the cultivation of MNS. The results are shown in table 1.

Expert positive factors

In this study, 16 questionnaires were distributed in two rounds of expert correspondence; 16 valid questionnaires were returned, and the recovery efficiency was 100.0%. All of them were above 70%, indicating that among the experts consulted, the motivation to participate in this study was high.

Expert authority factor

By counting the frequency of expert correspondence familiarity, the coefficients of expert familiarity (Cs) for the seven dimensions were calculated as 0.975, 0.900, 0.863, 0.963, 0.975, 0.900 and 0.813, and the overall expert familiarity coefficient (Cs) was 0.913. The statistical results are shown in online supplemental appendix S1. In addition, the experts judged each indicator on the basis of online supplemental appendix S2. The authority level of the experts' opinions in this study was 0.931, indicating that the experts were more authoritative.

The degree of coordination of expert opinions

In this study, for the first round of expert opinions, the corresponding Kendall coordination coefficient was 0.136 (p<0.05); for the second round of expert opinions, the corresponding Kendall coordination coefficient was 0.147 (p<0.05), indicating relatively high agreement of expert opinions. The statistical results are shown in table 2.

Table 1 General information of experts (n=16)

Items	Options	n	%
Age (years)	36–45	5	31.3
	≥46	11	68.7
Years of work (years)	15–20	4	25.0
	≥21	12	75.0
Academic qualifications	Bachelor's degree	8	50.0
	Master's degree	6	37.5
	Doctor	2	12.5
Title	Associate senior	6	37.5
	Senior	10	62.5
Graduate student mentors	Master's degree advisor	14	87.5
	PhD supervisor	2	12.5

Modification of evaluation indicators at all levels

After two rounds of expert consultation, the entries of the MNS Postgraduate Clinical Competence Assessment Scale (pretest version) were revised to increase the suitability of the scale for clinical practice. Based on the expert opinions, one entry in the original scale that duplicated other dimensions (attention to patient privacy protection in the D7 operation) was deleted, and revisions were carried out for eight of the entries. The final results obtained are shown in table 3. After two rounds of expert consultation, the MNS clinical competence evaluation index system, which includes seven primary indicators and 52 secondary indicators, was finally developed, as detailed in online supplemental appendices S3 and S4.

DISCUSSION

Based on the mini-CEX conceptual framework and the Delphi expert correspondence method, a clinical competence assessment index for MNS postgraduates was constructed for this study that included seven dimensions—operational skills, health assessment, humanistic care, clinical decision-making, health promotion, nurse–patient communication and organisational effectiveness—with 52 entries. In addition, the requirements of clinical nursing competence for MNS postgraduate students and the characteristics of the mini-CEX real-world assessment were combined for this study, adding operational skill and clinical decision-making dimensions. These adaptations are crucial because the MNS-mini-CEX scale constructed in this study is different from other nursing mini-CEX scales, as it is more applicable to the evaluation of the clinical competence of MNS postgraduate students.

Table 2 Coordination coefficient of expert opinion

Rounds	W value	X^2	df	P value
Round 1	0.136	130.266	60	< 0.001
Round 2	0.147	133.630	57	< 0.001

W, Kendall coefficient of concordance.

The correspondence experts in this study, all of whom have rich experience in clinical practice, clinical teaching and clinical management, came from five provinces and cities across China. Therefore, the experts in this study had good authority and demonstrated a high degree of representativeness. According to previous research,[22] the rate of return of valid questionnaires from experts in Delphi consulting should be more than 70% to support the conclusion of the study. In this study, 100% of the questionnaires were returned in the first and second rounds, demonstrating that the experts' motivation and cooperation were also high. The overall expert familiarity coefficient of this study was 0.906, the expert judgement coefficient was 0.950 and the expert authority coefficient was 0.931, which indicated that the expert authority of this study was good and that the study results were reliable.

The mini-CEX has been acknowledged as a practical assessment instrument.[23–27] Furthermore, it is regarded as a valuable tool for documenting direct supervision of clinical skills,[26–28] improving specialist–student relationships,[26 27] facilitating effective feedback[23 28] and improving learning.[29 30] Compared with the existing mini-CEX clinical practice assessment scale for postgraduate nursing students, this study retained the four dimensions of nurse–patient communication, health promotion, humanistic care and organisational effectiveness, and added the two dimensions of operational skills and clinical decision-making. The overall assessment dimension was deleted because it had a strong correlation with other dimensions of assessment, it could be easily duplicated with other dimensions within specific assessment items, and the scores derived from it could be duplicated easily as well, affecting the objectivity of the scoring. One study[16] confirmed that for Master of Nursing students, practical skills and clinical decision-making skills are among the key components; because the original mini-CEX scale scores the 'operational skills' dimension weakly, Master of Nursing students with strong communication skills and

Table 3 Comparison results before and after the amendment of the entry

Original scale entries	Modification comments	Revised entries
1. B4. Correctly assess changes in the patient's condition.	Suggestion: Delete the word 'changes'.	Correct assessment of the patient's condition.
2. C1. Ability to identify problems.	Suggestions: The word 'problems' for problems related to the patient's condition and safety or various clinical problems is not comprehensive; for more clarity, it is suggested that the word 'problems' be revised to 'clinical problems'.	Ability to identify clinical problems.
3. C6. Be able to analyse the factors associated with the development of the condition.	Suggestion: Add the word 'reason' in this sentence for a more comprehensive expression.	Can analyse the factors and causes associated with the development of the condition.
4. D2. Strictly implement the principle of aseptic operation in operation.	Suggestion: Amend 'operation' to 'aseptic operation'.	Aseptic operation strictly implements the principles of aseptic operation.
5. D4. Appropriate assessment of the patient and appropriate assistance when the patient is unable to cooperate with the operation.	Suggestion: Other entries already contain the assessment of patients and it is recommended that this entry be deleted.	Provide appropriate assistance when the patient is unable to cooperate with the operation.
6. D7. Pay attention to patient privacy protection during the operation.	Suggestion: Duplicate of the content of F7; suggest deleting this article.	Deleted.
7. F4. Ensure patient safety and protect patients when necessary.	Suggestion: The expression is not concise, and it is suggested that the phrase 'protect the patient when necessary' be deleted.	Ensure patient safety.
8. F6. Adopt a good attitude and firm and polite tone when you need to refuse a patient's request.	Suggestion: Limit to specific contexts.	To ensure patient safety, be firm and polite when you need to refuse unreasonable requests from patients.
9. F9. Can use appropriate methods to help patients build confidence to overcome the disease.	Suggestion: Change 'establish' to 'enhance' more precisely.	Can use appropriate methods to help patients increase their confidence in overcoming the disease.

weak operational skills may receive higher scores. Therefore, this study combined the requirements of clinical nursing competence for MNS postgraduate students and the characteristics of the mini-CEX real-world assessment and added the dimensions of 'operational skills' and 'clinical decision-making'.

At present, a standardised system has not yet been established for the cultivation and assessment of the clinical competence of MNS graduate students. Although existing studies have constructed assessment tools based on relevant theoretical frameworks, the differences in the specific implementation plans of major universities have led to limitations in the scope of application of each tool. An assessment tool for the clinical competence of MNS postgraduates based on the mini-CEX was developed for this study to improve the reference and basis for clarifying training priorities in the clinical teaching process; the resulting tool will help improve the construction of a training system for MNS postgraduates. In addition, an online platform for assessing postgraduate clinical competence in MNS with the help of a self-developed app was developed for this study. The instructors can evaluate the MNS postgraduates through mobile terminals (mobile app), which is convenient and operable and effectively improves the assessment efficiency. At the same time, the MNS postgraduates can receive and view feedback from the instructors on the mobile app to enhance online interaction between teachers and students. The back end of the app can be used for teaching management to export data, and after analysis, the data can be used to direct the continuous optimisation of the assessment scheme and assessment tools, and as a result, further improve the evaluation tools.

This study has several limitations. Due to time and manpower constraints, we were not able to apply the constructed MNS competency assessment tool, nor were we able to collect information on the effectiveness of its use in the field from master's degree nurses and instructors. In the future, we will develop detailed evaluation criteria for these indicators and apply them in clinical practice to verify their clinical applicability and validity.

CONCLUSION

Based on the mini-CEX framework and the Delphi expert consultation method, this study initially established the MNS core competency evaluation indices. This study has a high degree of credibility, provides a valid and reliable tool for evaluating the clinical practice competency of MNS in future medical school settings and provides a reference and a lesson for further improving the training and assessment programme of MNS. However, due to time constraints,

the developed indicators were not empirically studied. In the future, detailed evaluation criteria for these indicators may be developed to verify their clinical applicability and validity.

Contributors QP: conceptualisation, methodology, validation, investigation, data curation, writing—original draft. YG: conceptualisation, methodology, software, investigation, revision of the original manuscript. XG: resources, writing—review and editing, supervision, funding acquisition. NL: visualisation, writing—review and editing, supervision. All authors contributed to the article and approved the submitted version. XG is responsible for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study examined only the construction of the MNS competency assessment tool. As such, the study was considered a non-human subject study and did not require institutional review board approval. Participants or their proxies provided written informed consent.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

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Appendix I: The first round of expert consultation questionnaire

Dear Experts:

This study intends to build a scientific clinical competency evaluation tool for master's degree in nursing based on the Mini-CEX in medical education, taking the clinical competency of nurses as the theoretical basis, analyzing expert opinions and literature, summarizing relevant contents, and referring to the actual situation of China, so as to provide a reference for the clinical competency evaluation program of MNS. We are familiar with your rich experience in the field of postgraduate nursing education, as well as your profound knowledge. We invite you to participate in this research and look forward to your guidance, and thank you very much for your support of this study in your busy schedule!

The preliminary construction of the evaluation tool for clinical competence of nursing master degree students includes 7 dimensions (nurse-patient communication, health assessment, clinical decision-making, operational skills, health promotion, humanistic care, and organizational effectiveness) and 53 entries. Please evaluate the importance of these evaluation indexes, and your opinion will directly influence the construction of the subsequent evaluation index system! In order to ensure that this research project can be completed on time, please respond within one week!

Finally, I would like to express my gratitude to you again! I sincerely thank you for your participation in this study, and wish you good health and good work!

Part I Basic information of experts

1. Name：

2. Age(years)：

3. Workplace：

4. Years of work：

5. Education：

A.Bachelor's degree B.Master's degree C.Doctor D.Others：_____

6. Title：

A.Junior B.Intermediate C.Associate Senior D.Positive Senior E.Others：_____

5. Is a graduate advisor： A.Yes（Doctoral Supervisor/Master's degree advisor） B.No

6. What are your current role?（Multiple choices available）

A.Teaching B.Clinical C.Administration D.Management E.Scientific Research

Part II Consultation on Clinical Competency Evaluation Tool Indicators for Nursing Master Degree Students

Instructions:

This scale covers 7 dimensions with 53 entries. There are five different levels of importance, namely very important, relatively important, generally important, not too important, and not necessary, with scores of 5, 4, 3, 2, and 1.

If there is a need to adjust, revise, add or delete entries, you can directly modify in the "Revision" column.

Table 1 Consultation table of the clinical competence evaluation tool (scale dimensions) for nursing master's degree students

Dimensionality	Importance evaluation of indicators					Modify or delete comments
	Very important	More important	General importance	Not really important	Not important	
	5	4	3	2	1	
A Nurse-Patient Communication						
B Health assessments						
C Clinical Decision Making						
D Operating Skills						
E Health Education						
F Humanistic Care						
G Organizational effectiveness						

Other suggestions:

Table 2 Consultation table of the clinical competence evaluation tool (scale entries) for nursing master's degree students

Dimensionality	Items	Importance evaluation of indicators					Modify or delete comments
		Very important	More important	General importance	Not really important	Not important	
		5	4	3	2	1	
A Nurse-Patient Communication	A1 Appropriate self-introduction and addressing the patient or family						
	A2 Inform the patient or family of the purpose of the communication						
	A3 Confirm the patient's or family's ability to communicate, communicate in a language that the patient or family understands, and assess the patient's or family's grasp of the information when appropriate						
	A4 Ask questions and guide the patient or family when appropriate, and ask the patient's family to provide						

	correct and sufficient communication information when necessary						
	A5 Respond appropriately to patients when necessary						
	A6 Demonstrate respect and compassion for patients						
	A7 Not interrupting patients or family members inappropriately						
	A8 Use non-verbal communication when necessary to achieve good communication results						
	A9 Clearly thought out, well organized, well controlled pace						
	Supplementary indicators:						
B Health assessments	B1 Targeted physical examination						
	B2 Correct physical examination technique						
	B3 Comprehensive and accurate assessment						
	B4 Correctly assess changes in the patient's condition						

	B5 Properly assess potential risks						
	B6 Identify complications						
	B7 Proper use of specialty assessment tools						
	Supplementary indicators:						
C Clinical Decision Making	C1 Ability to identify problems						
	C2 Ability to assess current changes in the patient's condition						
	C3 Can clarify the focus of the patient's current condition observation						
	C4 Can make recommendations for decisions regarding patient conditions						
	C5 Can provide the care needed for the patient's current condition						
	C6 Be able to analyze the factors associated with the development of the condition						

	C7 Critical thinking						
	C8 Ability to provide feedback						
	Supplementary indicators:						
D Operating Skills	D1 Strictly implement the principle of aseptic operation in operation						
	D2 Follow the requirements of the core system of checking and identification of patients and the correct timing and method of checking medical prescriptions and medications during operation						
	D3 Appropriate assessment of the patient and appropriate assistance when the patient is unable to cooperate with the operation						
	D4 Perform the steps according to the needs of the disease and in a rational order						
	D5 Accurate operation process						

	D6 Respond appropriately to patient discomfort caused during operation						
	D7 Pay attention to patient privacy protection during operation						
	D8 Correct final disposal at the end of the operation						
	Supplementary indicators:						
E Health Education	E1 To inform the purpose of health promotion						
	E2Provide the appropriate health education knowledge needed						
	E3 Health promotion using easy-to-understand language						
	E4 Demonstrate and explain to patients when necessary						
	E5 Accurate mission content						

	E6 Identify patients with missionary knowledge						
	Supplementary indicators:						
F Humanistic Care	F1 Ability to build a good trusting relationship with patients						
	F2 Facing patients with a professional attitude and identity						
	F3 Able to notice and deal with patient discomfort in a timely manner						
	F4 Ensure patient safety and protect patients when necessary						
	F5 Respect the patient's wishes where possible						
	F6 Good attitude and firm and polite tone when you need to refuse a patient						
	F7 Protecting patient privacy						
	F8 Empathy for patients						

	F9 Can use appropriate methods to help patients build confidence to overcome the disease						
	Supplementary indicators:						
G Organizational effectiveness	G1 Ability to respond effectively to emergencies						
	G2 Proper time control and overall efficiency						
	G3 Focus on prioritization in nursing behaviors						
	G4 Efficient use of resources to provide optimal service						
	G5 Appropriate and flexible assessment processing						
	G6 High patient satisfaction						
	Supplementary indicators:						

Part III Expert familiarity with consulting content

Note: The degree of familiarity mainly includes very familiar, relatively familiar, generally familiar, not too familiar and unfamiliar, please refer to your own actual situation to fill in the corresponding column "√".

Dimensionality	Level of familiarity				
	Very familiar	Relatively familiar	Generally familiar	Not too familiar	Unfamiliar
A Nurse-Patient Communication					
B Health assessments					
C Clinical Decision Making					
D Operating Skills					
E Health Education					
F Humanistic Care					
G Organizational effectiveness					

Part IV The expert's judgment on the basis of consulting content

Note: Judgment is based on five aspects: intuition, theoretical knowledge and practical experience, etc. Please make your choice with reference to your own actual situation and put a tick in the corresponding column.

Basis of judgement	Degree of impact		
	Great	Medium	Little
Theoretical analysis			
Practical experience			
Bibliography			
Subjective judgement			

Appendix II: The second round of expert consultation questionnaire

Dear Experts,

This study intends to build a clinical competency evaluation tool for nursing master degree students based on the Mini-CEX in medical education, taking the clinical competency of nurses as the theoretical basis, through literature review and expert opinions, and aiming to provide reference for further standardization of the clinical competency evaluation tool for nursing master degree students. We are familiar with your rich knowledge and experience in the field of nursing graduate education, so we sincerely invite you to help and guide us to complete the consultation, and thank you very much for your support to this study in your busy schedule!

The clinical competence evaluation tool for nursing master degree students constructed by this project after the first round of correspondence includes 7 dimensions (nurse-patient communication, health assessment, clinical decision-making, operational skills, health promotion, humanistic care, and organizational effectiveness) and 52 entries. Please rate the importance of these evaluation entries. Please start to evaluate the importance of these evaluation indexes, and your opinion will directly influence the construction of the subsequent evaluation index system! In order to ensure that this research project can be completed on time, please reply within a week, and we sincerely thank you for your help and guidance!

Finally, I would like to express my gratitude to you again! I sincerely thank you for your participation in this study, and wish you good health and good work!

Part I Consultation on Clinical Competency Evaluation Tool Indicators for Nursing Master Degree Students

Instructions:

This scale covers 7 dimensions with 53 entries. There are five different levels of importance, namely very important, relatively important, generally important, not too important, and not necessary, with scores of 5, 4, 3, 2, and 1.

If there is a need to adjust, revise, add or delete entries, you can directly modify in the "Revision" column.

Table 1 Consultation table of the clinical competence evaluation tool (scale dimensions) for nursing master's degree students

Dimensionality	Importance evaluation of indicators					Modify or delete comments
	Very important	More important	General importance	Not really important	Not important	
	5	4	3	2	1	
A Nurse-Patient Communication						
B Health assessments						
C Clinical Decision Making						
D Operating Skills						
E Health Education						
F Humanistic Care						
G Organizational effectiveness						
Other suggestions:						

Table 2 Consultation table of the clinical competence evaluation tool (scale entries) for nursing master's degree students

Dimensionality	Items	Importance evaluation of indicators					Modify or delete comments
		Very important	More important	General importance	Not really important	Not important	
		5	4	3	2	1	
A Nurse-Patient Communication	A1 Appropriate self-introduction and addressing the patient or family						
	A2 Inform the patient or family of the purpose of the communication						
	A3 Confirm the patient's or family's ability to communicate, communicate in a language that the patient or family understands, and assess the patient's or family's grasp of the information when appropriate						
	A4 Ask questions and guide the patient or family when appropriate, and ask the patient's family to provide correct and sufficient communication						

	information when necessary						
	A5 Respond appropriately to patients when necessary						
	A6 Demonstrate respect and compassion for patients						
	A7 Not interrupting patients or family members inappropriately						
	A8 Use non-verbal communication when necessary to achieve good communication results						
	A9 Clearly thought out, well organized, well controlled pace						
	Supplementary indicators:						
B Health assessments	B1 Targeted physical examination						
	B2 Correct physical examination technique						
	B3 Comprehensive and accurate assessment						

	B4 Correct assessment of the patient's condition						
	B5 Properly assess potential risks						
	B6 Identifying complications						
	B7 Proper use of specialty assessment tools						
	Supplementary indicators:						
C Clinical Decision Making	C1 Ability to identify clinical problems						
	C2 Ability to assess current changes in the patient's condition						
	C3 Can clarify the focus of the patient's current condition observation						
	C4 Can make recommendations for decisions regarding patient conditions						
	C5 Can provide the care needed for the patient's current condition						
	C6 Can analyze the factors and causes associated						

	with the development of the condition						
	C7 Think critically						
	C8 Ability to provide feedback						
	Supplementary indicators:						
D Operating Skills	D1 Aseptic operation strictly implement the principles of aseptic operation						
	D2 Follow the requirements of the core system of checking and identification of patients and the correct timing and method of checking medical prescriptions and medications during operation						
	D3 Provide appropriate assistance when the patient is unable to cooperate with the operation						
	D4 Perform the steps in a reasonable order according to the needs of the disease						
	D5 Accurate operation process						

	D6 Respond appropriately to patient discomfort caused during operation						
	D7 Correct final disposal at the end of the operation						
	Supplementary indicators:						
E Health Education	E1 To inform the purpose of health promotion						
	E2Provide the appropriate health education knowledge needed						
	E3 Health promotion using easy-to-understand language						
	E4 Demonstrate and explain to patients when necessary						
	E5 Accurate mission content						

	E6 Identify patients with missionary knowledge						
	Supplementary indicators:						
F Humanistic Care	F1 Ability to build a good trusting relationship with patients						
	F2 Facing patients with a professional attitude and identity						
	F3 Able to notice and deal with patient discomfort in a timely manner						
	F4 Ensuring patient safety						
	F5 Respect the patient's wishes where possible						
	F6 To ensure patient safety, be firm and polite when you need to refuse unreasonable requests from patients						
	F7 Protecting patient privacy						
	F8 Empathy for patients						

	F9 Can use appropriate methods to help patients increase their confidence in overcoming the disease						
	Supplementary indicators:						
G Organizational effectiveness	G1 Ability to respond effectively to emergencies						
	G2 Proper time control and overall efficiency						
	G3 Focus on prioritization in nursing behaviors						
	G4 Efficient use of resources to provide optimal service						
	G5 Appropriate and flexible assessment processing						
	G6 High patient satisfaction						
	Supplementary indicators:						

Part II Expert familiarity with consulting content

Note: The degree of familiarity mainly includes very familiar, relatively familiar, generally familiar, not too familiar and unfamiliar, please refer to your own actual situation to fill in the corresponding column "√".

Dimensionality	Level of familiarity				
	Very familiar	Relatively familiar	Generally familiar	Not too familiar	Unfamiliar
A Nurse-Patient Communication					
B Health assessments					
C Clinical Decision Making					
D Operating Skills					
E Health Education					
F Humanistic Care					
G Organizational effectiveness					

Part III The expert's judgment on the basis of consulting content

Note: Judgment is based on five aspects: intuition, theoretical knowledge and practical experience, etc. Please make your choice with reference to your own actual situation and put a tick in the corresponding column.

Basis of judgement	Degree of impact		
	Great	Medium	Little
Theoretical analysis			
Practical experience			
Bibliography			
Subjective judgement			

Appendix III MNS Graduate Student Clinical Competency Evaluation Index

Nurse-Patient Communication（9 items）:	**Health Assessment（7 items）:**	**Clinical Decision Making（8 items）**
A1 Appropriate self-introduction and addressing the patient or family	B1 Targeted physical examination	C1 Ability to identify clinical problems
A2 Inform the patient or family of the purpose of the communication	B2 Correct physical examination technique	C2 Ability to assess current changes in the patient's condition
A3 Confirm the patient's or family's ability to communicate, communicate in a language that the patient or family understands, and assess the patient's or family's grasp of the information when appropriate	B3 Comprehensive and accurate assessment	C3 Can clarify the focus of the patient's current condition observation
A4 Ask questions and guide the patient or family when appropriate, and ask the patient's family to provide correct and sufficient communication information when necessary	B4 Correct assessment of the patient's condition	C4 Can make recommendations for decisions regarding patient conditions
A5 Responding appropriately to patients	B5 Properly assess potential risks	C5 Can provide the care needed for the

		patient's current condition
A6 Demonstrate respect and compassion for patients	B6 Identify complications	C6 Can analyze the factors and causes associated with the development of the condition
A7 Not interrupting patients or family members inappropriately	B7 Proper use of specialty assessment tools	C7 Critical thinking
A8 Use non-verbal communication when necessary to achieve good communication results		C8 Ability to provide feedback
A9 Clearly thought out, well organized, well controlled pace		
Operating Skills（7 items）:	**Health Education（6 items）:**	**Humanistic Care（9 items）:**
D1 Aseptic operation strictly implement the principles of aseptic operation	E1 To inform the purpose of health promotion	F1 Ability to build a good trusting relationship with patients
D2 Follow the requirements of the core system of checking and identification of patients and the correct timing and method of checking	E2 Provide the appropriate health education knowledge needed	F2 Facing patients with a professional attitude and identity

medical prescriptions and medications during operation		
D3 Provide appropriate assistance when the patient is unable to cooperate with the operation	E3 Health promotion using easy-to-understand language	F3 Able to notice and deal with patient discomfort in a timely manner
D4 Perform the steps in a reasonable order according to the needs of the disease	E4 Demonstrate and explain to patients when necessary	F4 Ensure patient safety
D5 Accurate operation process	E5 Accurate mission content	F5 Respect for patient wishes
D6 Respond appropriately to patient discomfort caused during operation	E6 Identify patients with missionary knowledge	F6 To ensure patient safety, be firm and polite when you need to refuse unreasonable requests from patients
D7 Correct final disposal at the end of the operation		F7 Protecting patient privacy
		F8 Empathy for patients
		F9 Can use appropriate methods to help patients increase their confidence in overcoming the disease

Organizational effectiveness（6 items）:		
G1 Ability to respond effectively to emergencies	G2 Proper time control and overall efficiency	G3 Focus on prioritization in nursing behaviors
G4 Efficient use of resources to provide optimal service	G5 Appropriate and flexible assessment processing	G6 High level of patient satisfaction

Appendix S1 Quantitative table of experts' familiarity with indicators

Familiarity level	Very familiar	More familiar	General familiarity	Less familiar	Not familiar
Quantified values	1	0.8	0.6	0.4	0.2
A Nurse-Patient Communication	14	2	0	0	0
B Health assessments	8	8	0	0	0
C Clinical Decision Making	7	7	2	0	0
D Operating Skills	13	3	0	0	0
E Health Education	14	2	0	0	0
F Humanistic Care	8	8	0	0	0
G Organizational effectiveness	7	4	4	1	0

Appendix S2 Quantification of the basis of expert judgment on indicators

Basis of judgement	Degree of impact		
	Great	Medium	Little
Theoretical analysis	13	3	0
Practical experience	13	1	2
Bibliography	2	9	5

Subjective judgement	0	6	10

Appendix S3 Results of the first round of expert correspondence

Items	Mean	Full Score Ratio	Coefficients of variation
Domain A: nurse-patient communication	4.8	81.3%	8.4%
A1 Appropriate self-introduction and addressing the patient or family	4.9	87.5%	7.0%
A2 Inform the patient or family of the purpose of the communication	4.6	68.8%	13.4%
A3 Confirm the patient's or family's ability to communicate, communicate in a language that the patient or family understands, and assess the patient's or family's grasp of the information when appropriate	5.0	100.0%	0.0%
A4 Ask questions and guide the patient or family when appropriate, and ask the patient's family to provide correct and sufficient communication information when necessary	4.9	93.8%	5.1%
A5 Respond appropriately to patients when necessary	4.6	62.5%	13.8%
A6 Demonstrate respect and compassion for patients	4.8	81.3%	8.4%
A7 Not interrupting patients or family members inappropriately	4.5	56.3%	14.1%
A8 Use non-verbal communication when necessary to achieve good communication results	4.8	81.3%	12.2%

A9 Clearly thought out, well organized, well controlled pace	4.8	87.5%	11.3%
Domain B: health assessments	4.9	87.5%	7.0%
B1 Targeted physical examination	4.9	87.5%	7.0%
B2 Correct physical examination technique	4.6	68.8%	13.4%
B3 Comprehensive and accurate assessment	4.8	81.3%	8.4%
B4 Correctly assess changes in the patient's condition	5.0	100.0%	0.0%
B5 Properly assess potential risks	5.0	100.0%	0.0%
B6 Identify complications	4.7	68.8%	10.2%
B7 Proper use of specialty assessment tools	4.9	87.5%	7.0%
Domain C: clinical decision making	4.9	87.5%	7.0%
C1 Ability to identify problems	4.9	87.5%	7.0%
C2 Ability to assess current changes in the patient's condition	4.9	93.8%	5.1%
C3 Can clarify the focus of the patient's current condition observation	5.0	100.0%	0.0%
C4 Can make recommendations for decisions regarding patient conditions	4.9	93.8%	5.1%
C5 Can provide the care needed for the patient's current condition	4.9	87.5%	7.0%

C6 Be able to analyze the factors associated with the development of the condition	4.7	68.8%	10.2%
C7 Critical thinking	4.8	75.0%	9.4%
C8 Ability to provide feedback	4.6	62.5%	13.8%
Domain D: operating skills	4.7	75.0%	12.8%
D1 Strictly implement the principle of aseptic operation in operation	5.0	100.0%	0.0%
D2 Follow the requirements of the core system of checking and identification of patients and the correct timing and method of checking medical prescriptions and medications during operation	5.0	100.0%	0.0%
D3 Appropriate assessment of the patient and appropriate assistance when the patient is unable to cooperate with the operation	4.6	62.5%	13.8%
D4 Perform the steps according to the needs of the disease and in a rational order	4.8	75.0%	9.4%
D5 Accurate operation process	4.7	75.0%	12.8%
D6 Respond appropriately to patient discomfort caused during operation	4.7	68.8%	10.2%
D7 Pay attention to patient privacy protection during operation	4.8	81.3%	8.4%
D8 Correct final disposal at the end of the operation	4.8	81.3%	8.4%

Domain E: health education	4.9	87.5%	7.0%
E1 To inform the purpose of health promotion	4.6	68.8%	13.4%
E2Provide the appropriate health education knowledge needed	4.9	93.8%	5.1%
E3 Health promotion using easy-to-understand language	4.8	81.3%	8.4%
E4 Demonstrate and explain to patients when necessary	4.8	75.0%	9.4%
E5 Accurate mission content	4.9	93.8%	5.1%
E6 Identify patients with missionary knowledge	4.8	87.5%	11.3%
Domain F: humanistic care	4.8	81.3%	8.4%
F1 Ability to build a good trusting relationship with patients	4.5	56.3%	14.1%
F2 Facing patients with a professional attitude and identity	4.7	75.0%	12.8%
F3 Able to notice and deal with patient discomfort in a timely manner	4.9	93.8%	5.1%
F4 Ensure patient safety and protect patients when necessary	4.9	93.8%	10.3%
F5 Respect the patient's wishes where possible	4.6	68.8%	13.4%
F6 Good attitude and firm and polite tone when you need to refuse a patient	4.0	37.5%	25.8%*
F7 Protecting patient privacy	4.7	68.8%	10.2%
F8 Empathy for patients	4.8	81.3%	8.4%

F9 Can use appropriate methods to help patients build confidence to overcome the disease	4.7	68.8%	10.2%
Domian G: organizational effectiveness	4.6	68.8%	15.9%
G1 Ability to respond effectively to emergencies	4.8	75.0%	9.4%
G2 Proper time control and overall efficiency	4.7	75.0%	12.8%
G3 Focus on prioritization in nursing behaviors	4.8	75.0%	9.4%
G4 Efficient use of resources to provide optimal service	4.6	68.8%	13.4%
G5 Appropriate and flexible assessment processing	4.6	75.0%	15.5%
G6 High patient satisfaction	4.6	75.0%	15.5%

Appendix S4 Results of the second round of expert correspondence

Items	Mean	Full Score Ratio	Coefficients of variation
Domain A: nurse-patient communication	4.8	75.0%	9.4%
A1 Appropriate self-introduction and addressing the patient or family	4.8	81.3%	8.4%
A2 Inform the patient or family of the purpose of the communication	4.8	87.5%	11.3%

A3 Confirm the patient's or family's ability to communicate, communicate in a language that the patient or family understands, and assess the patient's or family's grasp of the information when appropriate	4.9	93.8%	5.1%
A4 Ask questions and guide the patient or family when appropriate, and ask the patient's family to provide correct and sufficient communication information when necessary	4.8	81.3%	8.4%
A5 Respond appropriately to patients when necessary	4.4	56.3%	18.3%
A6 Demonstrate respect and compassion for patients	4.6	62.5%	10.8%
A7 Not interrupting patients or family members inappropriately	4.5	56.3%	14.1%
A8 Use non-verbal communication when necessary to achieve good communication results	4.5	62.5%	16.2%
A9 Clearly thought out, well organized, well controlled pace	5.0	100.0%	0.0%
Domain B: health assessments	4.9	93.8%	5.1%
B1 Targeted physical examination	4.8	81.3%	12.2%
B2 Correct physical examination technique	4.9	87.5%	7.0%
B3 Comprehensive and accurate assessment	4.8	81.3%	8.4%
B4 Correct assessment of the patient's condition	5.0	100.0%	0.0%

B5 Properly assess potential risks	5.0	100.0%	0.0%
B6 Identifying complications	4.8	75.0%	9.4%
B7 Proper use of specialty assessment tools	4.8	81.3%	8.4%
Domain C: clinical decision making	4.9	93.8%	5.1%
C1 Ability to identify clinical problems	4.9	87.5%	7.0%
C2 Ability to assess current changes in the patient's condition	4.8	81.3%	8.4%
C3 Can clarify the focus of the patient's current condition observation	5.0	100.0%	0.0%
C4 Can make recommendations for decisions regarding patient conditions	4.5	50.0%	11.5%
C5 Can provide the care needed for the patient's current condition	4.8	81.3%	8.4%
C6 Can analyze the factors and causes associated with the development of the condition	4.6	62.5%	10.8%
C7 Think critically	4.9	87.5%	7.0%
C8 Ability to provide feedback	4.8	75.0%	9.4%
Domian D: operating skills	4.6	68.8%	13.4%
D1 Aseptic operation strictly implement the principles of aseptic operation	4.9	93.8%	5.1%

D2 Follow the requirements of the core system of checking and identification of patients and the correct timing and method of checking medical prescriptions and medications during operation	4.9	93.8%	5.1%
D3 Provide appropriate assistance when the patient is unable to cooperate with the operation	4.7	68.8%	10.2%
D4 Perform the steps in a reasonable order according to the needs of the disease	4.9	87.5%	7.0%
D5 Accurate operation process	4.6	68.8%	13.4%
D6 Respond appropriately to patient discomfort caused during operation	4.8	75.0%	9.4%
D7 Correct final disposal at the end of the operation	4.8	75.0%	9.4%
Domian E: health education	4.9	87.5%	7.0%
E1 To inform the purpose of health promotion	4.8	81.3%	8.4%
E2 Provide the appropriate health education knowledge needed	5.0	100.0%	0.0%
E3 Health promotion using easy-to-understand language	4.8	81.3%	8.4%
E4 Demonstrate and explain to patients when necessary	4.8	81.3%	8.4%
E5 Accurate mission content	4.9	93.8%	5.1%
E6 Identify patients with missionary knowledge	4.6	68.8%	13.4%

Domian F: humanistic care	4.9	87.5%	7.0%
F1 Ability to build a good trusting relationship with patients	4.8	75.0%	9.4%
F2 Facing patients with a professional attitude and identity	4.9	87.5%	7.0%
F3 Able to notice and deal with patient discomfort in a timely manner	4.8	81.3%	8.4%
F4 Ensure patient safety	4.9	93.8%	5.1%
F5 Respect the patient's wishes where possible	4.6	62.5%	10.8%
F6 To ensure patient safety, be firm and polite when you need to refuse unreasonable requests from patients	4.6	68.8%	13.4%
F7 Protecting patient privacy	4.9	87.5%	7.0%
F8 Empathy for patients	4.7	68.8%	10.2%
F9 Can use appropriate methods to help patients increase their confidence in overcoming the disease	4.6	62.5%	10.8%
Domian G: organizational effectiveness	4.5	56.3%	14.1%
G1 Ability to respond effectively to emergencies	4.7	68.8%	10.2%
G2 Proper time control and overall efficiency	4.6	68.8%	13.4%
G3 Focus on prioritization in nursing behaviors	4.8	81.3%	8.4%

G4 Efficient use of resources to provide optimal service	4.7	75.0%	12.8%
G5 Appropriate and flexible assessment processing	4.3	50.0%	21.9%
G6 High patient satisfaction	4.4	50.0%	14.2%