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# BMJ Open

## Instruments for measuring patient health education competence among nursing staff: Protocol for a COSMIN-based systematic review

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3 **1 Instruments for measuring patient health education competence among nursing**  
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5 **2 staff: Protocol for a COSMIN-based systematic review**  
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48  
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56 24 **ABSTRACT**  
57

58 25 **Introduction** Health education, as a crucial strategic measure of disease prevention and  
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1 control in the 21st century, has become an important part of healthcare. As the main  
2 deliverers of patient health education, nursing staff's patient health education  
3 competence (PHEC) has received much attention. Instruments for assessing the PHEC  
4 of nursing staff have been developed internationally, but there is a lack of systematic  
5 reviews and evaluations of the psychometric properties of these instruments. To  
6 effectively select appropriate PHEC assessment instruments in specific contexts, a  
7 systematic and comprehensive review and evaluation of these measurement instruments  
8 are needed. The goal of this systematic review is to systematically evaluate the  
9 psychometric properties of existing PHEC instruments.

10 **Methods and analysis** In this study, eight databases will be searched between March  
11 1, 2023, and March 31, 2023, to retrieve studies that include instrument(s) measuring  
12 the PHEC of nursing staff. Two researchers will independently perform literature  
13 screening, data extraction, and literature evaluation. In case of disagreement, a third  
14 researcher will be involved in the resolution. The measurement properties of PHEC  
15 assessment instruments will be systematically reviewed based on the consensus-based  
16 standards for the selection of health measurement instruments (COMSIN) methodology  
17 and guideline.

18 **Ethics and dissemination** Ethical approval is not applicable for this study. We will  
19 share the findings from the study at national and/or international conferences and in a  
20 peer-reviewed journal in the fields of health education and/or patient education.

21 **PROSPERO registration number** CRD42023393293

## 22 **Strengths and limitations of this study**

- 23 ➤ To our knowledge, this will be the first COSMIN-based systematic review of  
24 patient health education competence (PHEC) assessment instruments for nursing  
25 staff.

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3 1 ➤ The Preferred Reporting Items for Systematic Reviews and Meta-analyses  
4  
5 2 protocols (PRISMA-P) 2020 checklist will be used to guide the implementation  
6  
7 3 and report of the protocol and systematic review.  
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10 4 ➤ The consensus-based standards for the selection of health measurement  
11  
12 5 instruments (COSMIN) methodology will be used to evaluate the methodological  
13  
14 6 quality of included studies on measurement properties of the instruments and the  
15  
16 7 quality of included instruments.  
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18 8 ➤ The systematic review may fail to include relevant literature published outside of  
19  
20 9 the searched databases.  
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## 24 10 **1. INTRODUCTION**

25  
26 11 Health education has been identified by the World Health Organization (WHO) as  
27  
28 12 one of the three crucial strategic measures of disease prevention and control in the 21st  
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30 13 century, and it is the most economical and effective measure for improving public  
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32 14 health.[1] Health education for patients is a crucial part of the healthcare services  
33  
34 15 provided by health professionals. In clinical practice, health professionals are often  
35  
36 16 required to develop patient education programs to impart to patients knowledge and  
37  
38 17 skills for health restoration and promotion.[2,3] Health education for patients can  
39  
40 18 improve their understanding of their own health status and disease management  
41  
42 19 measures, which can relieve patients' anxiety and improve their compliance and  
43  
44 20 satisfaction with medical staff, thus improving their health status and quality of life.[4]  
45  
46 21 These better patient outcomes could reduce the burden of disease on patients and  
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48 22 society at the economic level.[5,6] As the world's largest group of health professionals  
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50 23 and the health professionals who have the closest contact with patients, nursing staff  
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52 24 plays an important role in patient health education.[5,7]  
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58 25 Patient health education competency (PHEC) refers to the specific qualities that  
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1 health educators should have to conduct effective health education activities with  
2 patients.[8,9] PHEC is an essential professional competency for nursing staff and  
3 determines the quality of patient education.[10-13] However, in existing studies, the  
4 PHEC of clinical nurses is often the lowest-rated area of nursing competency.[14,15]  
5 Therefore, the development and strengthening of PHEC for nurses are extremely  
6 important to improve the quality of patient education, patient care, patient safety, and  
7 the development of nursing careers. In addition, we should pay attention to nursing  
8 students' PHEC because they are the mainstay of the clinical nurse workforce.

9 Accurate measurement of PHEC is important because it can be used to assess the  
10 PHEC status of nursing staff and to develop targeted strategies based on the nursing  
11 staff's PHEC. Moreover, it can be used in research to assess the effectiveness of  
12 relevant PHEC interventions. Currently, relevant measurement instruments have been  
13 developed internationally: for example, a scale for measuring the PHEC of registered  
14 nurses developed by Lin et al. in 2017,[16] a PHEC competency assessment scale  
15 developed by Hwang et al. based on a literature review and the Delphi method,[17] and  
16 a Spanish version of the nurse PHEC scale developed by Pueyo-Garrigues et al.[18]  
17 Although related instruments are available for assessing PHEC in nursing staff, these  
18 evaluation instruments have been developed in different settings and their validation  
19 varies considerably, with none considered the gold standard.

20 In this study, we defined PHEC as the specific qualities that must be possessed by  
21 health educators to provide health education to patients, including knowledge, skills,  
22 beliefs or attitudes, self-concept, personality qualities, and motivation. Although there  
23 has been a review of PHEC measurement instruments for nursing staff, this review has  
24 some limitations on its rigor.[19] First, this review included not only measurement  
25 instruments for PHEC but also systems for evaluating PHEC, which are different from

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3 1 measurement instruments. Second, this review did not systematically evaluate the  
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5 2 measurement properties of instruments for measuring PHEC based on related  
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7 3 guidelines. However, a systematic and comprehensive review of PHEC measurement  
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9 4 instruments is crucial for guiding the selection of instruments and/or guiding the  
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11 5 development and refinement of high-quality instruments in the future. The consensus-  
12  
13 6 based standards for the selection of health measurement instruments (COSMIN)  
14  
15 7 methodology provides resources to systematically review measurement instruments  
16  
17 8 and evaluate them in terms of both methodological quality and quality of measurement  
18  
19 9 properties to select instruments that are of high quality for study purposes and provide  
20  
21 10 an evidence-based foundation for future high-level instrument development.[20] Thus,  
22  
23 11 this study will conduct a comprehensive and rigorous systematic review of PHEC  
24  
25 12 assessment instruments based on the COSMIN methodology, which aims to evaluate  
26  
27 13 the measurement properties of these instruments, provide a reference for nursing staff  
28  
29 14 and researchers to accurately and effectively assess PHEC, and provide  
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31 15 recommendations for researchers to develop and improve PHEC assessment  
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33 16 instruments.

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40 17 This systematic review will answer the following questions: (1) What instruments  
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42 18 are available for assessing the PHEC of nursing staff? (2) What are the characteristics  
43  
44 19 of these instruments? (3) What is the methodological quality of studies on the  
45  
46 20 measurement properties of these instruments? (4) How about these instruments'  
47  
48 21 measurement properties, interpretability, and feasibility? (5) What are the similarities  
49  
50 22 and differences between these instruments? (6) What are the knowledge and research  
51  
52 23 gaps in this area?

## 53 54 55 56 24 **2. METHODS**

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58 25 The review proposed by this protocol will follow the COSMIN methodology for  
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1 conducting systematic reviews of psychometric properties and will be reported  
2 following the Preferred Reporting Items for Systematic Reviews and Meta-analyses  
3 protocols (PRISMA-P) 2020 checklist.[21,22] We registered the protocol in the  
4 International Prospective Register of Systematic Reviews (PROSPERO,  
5 CRD42023393293).

## 6 **Inclusion and exclusion criteria of studies**

### 7 **Inclusion criteria**

8 Studies will be included if they (1) address instrument(s) for measuring the PHEC  
9 of nurses or nursing students, (2) describe the processes of development and evaluation  
10 of one or more measurement properties for eligible instrument(s), (3) discuss  
11 instruments designed to measure the PHEC of health professionals (the literature  
12 explicitly mentions that it applies to nursing staff as well), and (4) have full-text  
13 availability. If full-text versions of the studies are not available online, the authors of  
14 these articles will be contacted, and articles for which valid information was not  
15 available after contacting the authors will be excluded.

### 16 **Exclusion criteria**

17 Studies will be excluded if they are (1) not primary studies (e.g. biographies,  
18 addresses, and editorials) or are case studies, (2) reports that used the instruments only  
19 for outcome measurements, (3) secondary studies (e.g. reviews and/or systematic  
20 reviews), or (4) duplicate published studies.

### 21 **Search strategy**

22 A systematic search will be performed between March 1, 2023, and March 31, 2023,  
23 in six English databases (i.e. CINAHL, EMBASE, Ovid Medline, PubMed, PsycINFO,  
24 and Web of Science) and two Chinese databases (i.e. CNKI and WANFANG DATA).  
25 We include Chinese databases since the researchers speak Chinese as their native  
26



1 language. We will also search for references in all eligible literature to prevent  
2 omissions. The search time limit is from the library's creation date to the search date.  
3 A literature search will be conducted using a combination of subject terms and free  
4 words. The major search concepts will be nursing, health education, competence,  
5 instrument, and measurement properties. Related comprehensive and sensitive search  
6 strategies developed by other researchers will also be used in this literature search,  
7 including (1) the search filter developed by the University of Oxford for finding  
8 PROMs,[23] (2) the sensitive PubMed search filter for measuring attributes developed  
9 by Terwee et al., and (3) corresponding search filters applicable to other databases.[24]  
10 Our study will examine results reported by nurses or nursing students, so the first filter  
11 will be adjusted appropriately (e.g. we will remove those sections that are relevant to  
12 the quality of life and patient-reported outcomes). The search strategy constructed for  
13 PubMed is described in Table S1 in the supplementary file. The search strategy for the  
14 Chinese databases is shown in Table S2 in the supplementary file.

### 15 **Study screening**

16 Covidence will be used to manage the references. First, duplicates from the eight  
17 databases will be removed with Covidence. After the initial screening, both researchers  
18 will independently review and screen titles, abstracts, and full-text articles with the  
19 support of Covidence. In case of disagreement, a third researcher will be consulted to  
20 screen the literature. The screening processes of this study are shown in Figure 1.

### 21 **Data extraction**

22 The two researchers will independently extract data from the included papers and  
23 resolve their differences through discussion. We will extract the data on the  
24 characteristics of the instruments (including instrument name, developer(s)/year  
25 developed, construct(s), targeted population, mode of administration, recall period,

1 (sub)scale(s)/(number of items), response options, range of scores/scoring, original  
2 language, and available translations; see Table S3 in the supplementary file), the  
3 characteristics of the included populations (including sample size, age, gender, setting,  
4 country, and language; see Table S4 in the supplementary file.), the results on the  
5 psychometric properties (Table S5 in the supplementary file), and information about  
6 the interpretability (Table S6 in the supplementary file) and feasibility (Table S7 in the  
7 supplementary file) of the included instruments.

8 The term ‘outcome measure instrument development’ will be used instead of the  
9 original ‘patient-reported outcome measure development’ to more accurately reflect the  
10 inclusion of studies that examined outcomes reported by nurses or nursing students  
11 rather than patients.

## 12 **Quality appraisal and Data synthesis**

13 Two researchers will independently assess the quality of eligible studies using the  
14 COSMIN Risk of Bias checklist, which is divided into three sections: content validity  
15 (instrument development and content validity), internal structure (structural validity,  
16 internal consistency, and cross-cultural validity/measurement invariance), and other  
17 measurement properties (reliability, measurement error, criterion validity, hypothesis  
18 testing for construct validity, and responsiveness).[20,21,25] Each measurement  
19 property will be evaluated with 3 to 35 items, and the items will be rated on a five-level  
20 score of ‘very good’, ‘adequate’, ‘doubtful’, ‘inadequate’, or ‘not applicable.’ Based on  
21 the ‘the worst score counts’ principle, each measurement property’s overall  
22 methodological quality score is expressed by taking the lowest rating of any standard  
23 in the box. Subsequently, the two researchers will apply the updated criteria for good  
24 measurement properties alone to evaluate the reliability and validity of the instruments  
25 themselves, and the quality of the evidence will be graded using the Grading of

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3 1 Recommendations Assessment, Development, and Evaluation (GRADE) approach. In  
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5 2 case of disagreement, a third researcher will be consulted.  
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8 3 We will work according to the following three steps. In the first step, two  
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10 4 investigators will apply the COSMIN Risk of Bias checklist to evaluate the  
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12 5 methodological quality of each eligible study individually.[25] The final consensus on  
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14 6 the results of the methodological quality will be presented in Tables S8 and S8-1 in the  
15  
16 7 supplementary file. In the second step, the updated criteria for good measurement  
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18 8 properties will be applied to evaluate the quality of evidence for each measured property,  
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20 9 and the evaluation results will be shown in Tables S5 and S5-1 in the supplementary  
21  
22 10 file.[21,26] This section mainly evaluates the strengths and weaknesses of the  
23  
24 11 measurement properties. Among these, the quality of content validity will be evaluated  
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26 12 according to the COSMIN methodology for content validity in three aspects: the  
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28 13 relevance, comprehensiveness, and comprehensibility of items, which can be ‘sufficient  
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30 14 (+)’, ‘insufficient (-)’, ‘indeterminate (?)’, or ‘inconsistent ( $\pm$ )’.[26,27] The quality of  
31  
32 15 the remaining measurement properties (structural validity, internal consistency, cross-  
33  
34 16 cultural validity, measurement invariance, reliability, measurement error, criterion  
35  
36 17 validity, construct validity, and responsiveness) will be evaluated by applying the  
37  
38 18 COSMIN quality criteria, which can be ‘sufficient (+)’, ‘insufficient (-)’, and  
39  
40 19 ‘indeterminate (?)’.[21] The corresponding results will be reported in the rating  
41  
42 20 columns of Table S5 in the supplementary file, and the results of rating content validity  
43  
44 21 will be presented separately in Table S5-1 in the supplementary file. In the third step, a  
45  
46 22 modified GRADE approach will be used to rate the quality of the above evidence,  
47  
48 23 reflecting the level of confidence in the quality of the evidence. To evaluate the  
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50 24 content’s validity, three of these factors are applicable: risk of bias, inconsistency, and  
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52 25 indirectness.[27] Assuming that the level of evidence quality for each of the remaining  
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1 measurement properties is high, the quality of the evidence will be downgraded by  
2 considering the following factors: risk of bias, inconsistency, imprecision, and  
3 indirectness.[21] The quality of evidence will be divided into four levels: 'high',  
4 'moderate', 'low', or 'very low'. [20,21] The corresponding results will be displayed in  
5 Table S9 in the supplementary file. Two investigators will independently grade and  
6 cross-check the results. In case of disputes, final decisions will be made in consultation  
7 with the third investigator.

### 8 **Patient and public involvement**

9 Neither patients nor the public will be involved in this study.

### 10 **Ethics and dissemination**

11 Ethical approval is not applicable for this study. We will share the findings from  
12 the study at national and/or international conferences and in a peer-reviewed journal in  
13 the fields of health education and/or patient education.

## 14 **3. DISCUSSION**

15 To our knowledge, this will be the first COSMIN-based systematic review of  
16 PHEC assessment instruments for nursing staff, which will be reported following the  
17 Preferred Reporting Items for Systematic Reviews and Meta-analyses protocols  
18 (PRISMA-P) 2020 checklist. This systematic review will provide a comprehensive  
19 rating of the level of evidence for each measurement property of the PHEC assessment  
20 instruments, which will be based on an evaluation of the measurement properties of all  
21 included instruments and the methodological quality of the studies. Through this study,  
22 we will be able to develop recommendations on the use of existing qualified instruments  
23 in clinical practice and research that could assist nursing staff and researchers in the  
24 accurate and valid assessment of PHEC. This review may provide an evidence-based  
25 foundation for the development, design, validation, and use of future instruments by

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3 1 identifying problems in instrument development and validation and therefore help  
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5 2 researchers to develop and improve these instruments.  
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10 4 **Author contributions** All authors have read and agreed to the published version of the  
11  
12 5 manuscript.

13  
14 6 Conceptualization: QC, ST, SW;

15  
16 7 Methodology: QC, ST, ZS;

17  
18 8 Data curation: QC, SW, KL;

19  
20 9 Writing—original draft preparation: SW, KL, QC;

21  
22 10 Writing—review and editing: QC, ST, ZS;

23  
24 11 Supervision: QC and ST.

25  
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27  
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29  
30 14 **Competing interests** None declared.

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32 15 **Patient consent** Not required.

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34 16 **Data sharing statement** No additional data available.  
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#### 18 **List of Figures:**

19 Figure 1. Flowchart of literature selection process

#### 20 **List of Supplementary File Tables:**

21 Table S1. Search strategy for PubMed

22 Table S2. Search strategy for Chinese database

23 Table S3. Characteristics of the included instrument

24 Table S4. Characteristics of the included study population

25 Table S5: Rating the measurement properties of the instruments

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3 1 Table S5-1: Rating of the content validity of instruments  
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5 2 Table S6: Information on interpretability of instruments  
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7 3 Table S7: Information on feasibility of instruments  
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10 4 Table S8: Quality of studies on measurement properties  
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12 5 Table S8-1: Quality of the instrument development  
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14 6 Table S9: Quality of the evidence for measurement properties of the instruments  
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19 8 **References:**  
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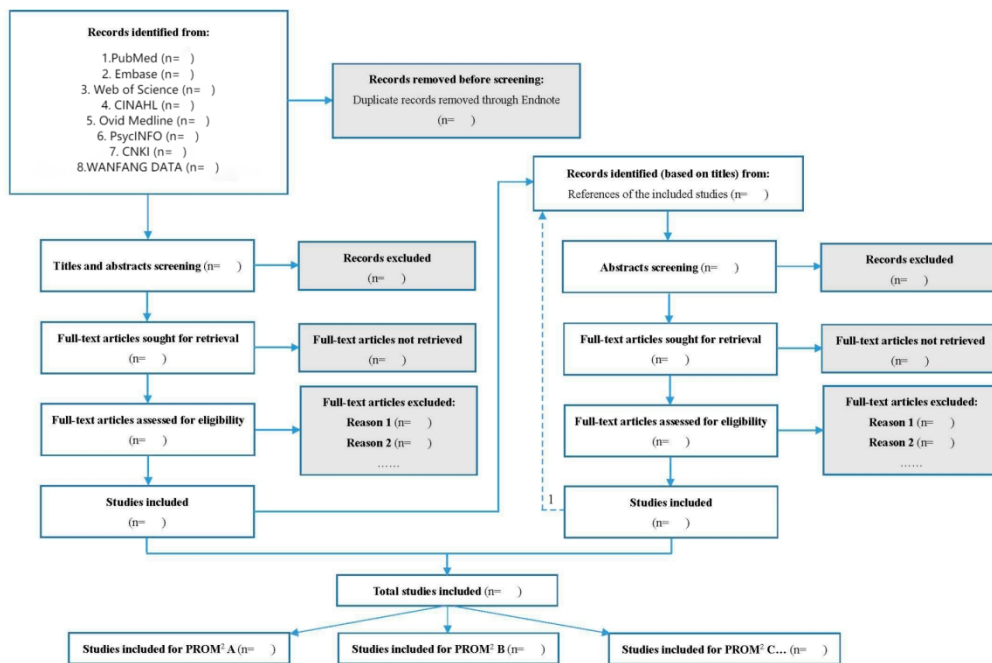
- 21 9 1. Organization WH. Health education: theoretical concepts, effective strategies and  
22 core competencies: a foundation document to guide capacity development of health  
23 educators. 2012. Available from:  
24 [https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB\\_2012\\_EN\\_13](https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB_2012_EN_13)  
25 [62.pdf?sequen](https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB_2012_EN_13)  
26  
27 10 2. Russell KA. Nurse practice acts guide and govern nursing practice. *J Nurs Regul*  
28 2012;3(3):36-42. doi: [https://doi.org/10.1016/S2155-8256\(15\)30197-6](https://doi.org/10.1016/S2155-8256(15)30197-6)  
29  
30 11 3. Wittink H, Oosterhaven J. Patient education and health literacy. *Musculoskelet Sci*  
31 *Pract* 2018;38:120-7. doi: 10.1016/j.msksp.2018.06.004.  
32  
33 12 4. Turner A, Anderson JK, Wallace LM, et al. An evaluation of a self-management  
34 program for patients with long-term conditions. *Patient Educ Couns*  
35 2015;98(2):213-9. doi: 10.1016/j.pec.2014.08.022.  
36  
37 13 5. Lin P, Gao C, Su S, et al. Teaching principles: The applications in nursing practice.  
38 Taipei: Farseeing. 2005.  
39  
40 14 6. Siegel KR, Ali MK, Zhou X, et al. Cost-effectiveness of interventions to manage  
41 diabetes: has the evidence changed since 2008? *Diabetes Care* 2020;43(7):1557-  
42 92. doi: 10.2337/dci20-0017.  
43  
44  
45  
46  
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48  
49  
50  
51  
52  
53  
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55  
56  
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58  
59  
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- 1  
2  
3 1 7. Koutsopoulou S, Papathanassoglou ED, Katapodi MC, et al. Nurses as information  
4  
5  
6 2 providers to cancer patients: Critical review of the evidence. *J Clin Nurs*  
7  
8 3 2010;19(5-6):749-65. doi: 10.1111/j.1365-2702.2009.02954.x.
- 9  
10 4 8. Hwang H-L, Kuo T-Y. Competency in delivering health education: A concept  
11  
12 5 analysis. *J Interprof Educ Pract* 2018;11:20-5. doi:  
13  
14 6 <https://doi.org/10.1016/j.xjep.2018.02.005>
- 15  
16  
17 7 9. Karimi Moonaghi H, Emami Zeydi A, Mirhaghi A. Patient education among nurses:  
18  
19 8 bringing evidence into clinical applicability in Iran. *Invest Educ Enferm*  
20  
21 9 2016;34(1):137-51. doi: 10.17533/udea.iee.v34n1a16.
- 22  
23  
24 10 10. Flinkman M, Leino-Kilpi H, Numminen O, et al. Nurse Competence Scale: a  
25  
26 11 systematic and psychometric review. *J Adv Nurs* 2017;73(5):1035-50. doi:  
27  
28 12 10.1111/jan.13183.
- 29  
30  
31 13 11. Ko Y, Yu S. Core nursing competency assessment tool for graduates of  
32  
33 14 outcome-based nursing education in South Korea: A validation study. *Jpn J Nurs*  
34  
35 15 *Sci* 2019;16(2):155-71. doi: 10.1111/jjns.12223.
- 36  
37  
38 16 12. Nilsson J, Engström M, Florin J, et al. A short version of the nurse professional  
39  
40 17 competence scale for measuring nurses' self-reported competence. *Nurse Educ*  
41  
42 18 *Today* 2018;71:233-9. doi: 10.1016/j.nedt.2018.09.028.
- 43  
44  
45 19 13. Wilkinson CA. Competency assessment tools for registered nurses: An integrative  
46  
47 20 review. *J Contin Educ Nurs* 2013;44(1):31-7. doi: 10.3928/00220124-20121101-  
48  
49 21 53.
- 50  
51  
52 22 14. Cowan DT, Wilson-Barnett DJ, Norman IJ, et al. Measuring nursing competence:  
53  
54 23 Development of a self-assessment tool for general nurses across Europe. *Int J Nurs*  
55  
56 24 *Stud* 2008;45(6):902-13. doi: 10.1016/j.ijnurstu.2007.03.004.
- 57  
58  
59 25 15. Pueyo-Garrigues M, Whitehead D, Pardavila-Belio MI, et al. Health education: a  
60

- 1  
2  
3 1 Rogerian concept analysis. *Int J Nurs Stud* 2019;94:131-8. doi:  
4  
5 2 10.1016/j.ijnurstu.2019.03.005.  
6  
7  
8 3 16. Lin LY, Wang RH. Patient Education Competence Scale for Registered Nurses in  
9  
10 4 Taiwan: Scale development and psychometric validation. *Jpn J Nurs Sci*  
11  
12 5 2017;14(2):117-25. doi: 10.1111/jjns.12141.  
13  
14  
15 6 17. Hwang HL, Kuo ML, Tu CT. Health education and competency scale:  
16  
17 7 Development and testing. *J Clin Nurs* 2018;27(3-4):e658-e67. doi:  
18  
19 8 10.1111/jocn.14116.  
20  
21  
22 9 18. Pueyo-Garrigues M, Pardavila-Belio MI, Whitehead D, et al. Nurses' knowledge,  
23  
24 10 skills and personal attributes for competent health education practice: An  
25  
26 11 instrument development and psychometric validation study. *J Adv Nurs*  
27  
28 12 2021;77(2):715-28. doi: 10.1111/jan.14632.  
29  
30  
31 13 19. Mi Y, Wu D, Wei ZZ, et al. Research progress on evaluation tool for health  
32  
33 14 education competency of nursing staff. *Chinese Nursing Research*  
34  
35 15 2020;34(11):1983-7.  
36  
37  
38 16 20. Prinsen CA, Mokkink LB, Bouter LM, et al. COSMIN guideline for systematic  
39  
40 17 reviews of patient-reported outcome measures. *Qual Life Res* 2018;27:1147-57. doi:  
41  
42 18 10.1007/s11136-018-1798-3.  
43  
44  
45 19 21. Mokkink LB, Prinsen C, Patrick DL, et al. COSMIN methodology for systematic  
46  
47 20 reviews of patient-reported outcome measures (PROMs). User manual.  
48  
49 21 2018;78(1):6-63. Available from: [https://www.cosmin.nl/wp-](https://www.cosmin.nl/wp-content/uploads/COSMIN-syst-review-for-PROMs-manual_version-1_feb-2018-1.pdf)  
50  
51 22 [content/uploads/COSMIN-syst-review-for-PROMs-manual\\_version-1\\_feb-2018-](https://www.cosmin.nl/wp-content/uploads/COSMIN-syst-review-for-PROMs-manual_version-1_feb-2018-1.pdf)  
52  
53 23 [1.pdf](https://www.cosmin.nl/wp-content/uploads/COSMIN-syst-review-for-PROMs-manual_version-1_feb-2018-1.pdf)  
54  
55  
56 24 22. Page MJ, Moher D, Bossuyt PM, et al. PRISMA 2020 explanation and elaboration:  
57  
58 25 updated guidance and exemplars for reporting systematic reviews. *BMJ* 2021;372.



- 1  
2  
3 1 doi: 10.1136/bmj.n160.  
4  
5  
6 2 23. Mackintosh A, Comabella C, Hadi M, et al. PROM group construct & instrument  
7  
8 3 type filters. Department of Public Health, University of Oxford, Oxford. 2010.  
9  
10 4 Available from: [https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-](https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-2010.pdf)  
11  
12 5 [2010.pdf](https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-2010.pdf)  
13  
14  
15 6 24. Terwee CB, Jansma EP, Riphagen II, et al. Development of a methodological  
16  
17 7 PubMed search filter for finding studies on measurement properties of  
18  
19 8 measurement instruments. *Qual Life Res* 2009;18:1115-23. doi: 10.1007/s11136-  
20  
21 9 009-9528-5.  
22  
23  
24 10 25. Mokkink LB, De Vet HC, Prinsen CA, et al. COSMIN risk of bias checklist for  
25  
26 11 systematic reviews of patient-reported outcome measures. *Qual Life Res*  
27  
28 12 2018;27:1171-9. doi: 10.1007/s11136-017-1765-4.  
29  
30  
31 13 26. Terwee CB, Prinsen CA, Chiarotto A, et al. COSMIN methodology for evaluating  
32  
33 14 the content validity of patient-reported outcome measures: a Delphi study. *Qual*  
34  
35 15 *Life Res* 2018;27:1159-70. doi: 10.1007/s11136-018-1829-0.  
36  
37  
38 16 27. Terwee CB, Prinsen C, Chiarotto A, et al. COSMIN methodology for assessing the  
39  
40 17 content validity of PROMs–user manual. Amsterdam: VU University Medical  
41  
42 18 Center. 2018. Available from: [https://cosmin.nl/wp-content/uploads/COSMIN-](https://cosmin.nl/wp-content/uploads/COSMIN-methodology-for-content-validity-user-manual-v1.pdf)  
43  
44 19 [methodology-for-content-validity-user-manual-v1.pdf](https://cosmin.nl/wp-content/uploads/COSMIN-methodology-for-content-validity-user-manual-v1.pdf)  
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Table S1. Search strategy for PubMed

1	#1	nurs*
2	#2	((((((((Health Education[Mesh] OR Patient Education as Topic[Mesh]) OR (health education*[tiab])) OR (education, health[tiab])) OR (patient education*[tiab])) OR (education program*[tiab])) OR (educational program*[tiab])) OR (education, patient*[tiab])) OR (education of patient*[tiab])) OR (nursing education*[tiab])) OR (hospital education*[tiab])) OR (educational activit*[tiab])) OR ((educat*[tiab]) AND (individual patient*[tiab]))
3	#3	((((((((professional competence[MeSH]) OR (professional competence[tiab])) OR (competence, professional[tiab])) OR (generalization of expertise[tiab])) OR (expertise generalization[tiab])) OR (technical expertise[tiab])) OR (expertise, technical[tiab])) OR (competenc*[tiab] OR capabilit*[tiab] OR capacit*[tiab] OR abilit*[tiab])) OR ((skill*[tiab] OR belief[tiab] OR attitude[tiab]) AND (knowledge[tiab]))
4	#4	(report[tiab] OR reported[tiab] OR reporting[tiab] OR rated[tiab] OR rating[tiab] OR ratings[tiab] OR based[tiab] OR assessed[tiab] OR assessment[tiab] OR assessments[tiab] OR disability[tiab] OR function[tiab] OR functional[tiab] OR functions[tiab] OR subjective[tiab] OR utility[tiab] OR utilities[tiab] OR wellbeing[tiab] OR well being[tiab]) AND (index[tiab] OR indices[tiab] OR instrument[tiab] OR instruments[tiab] OR measure[tiab] OR measures[tiab] OR questionnaire[tiab] OR questionnaires[tiab] OR profile[tiab] OR profiles[tiab] OR scale[tiab] OR scales[tiab] OR score[tiab] OR scores[tiab] OR status[tiab] OR survey[tiab] OR surveys[tiab])
5	#5	(instrumentation[sh] OR methods[sh] OR "Validation Studies"[pt] OR "Comparative Study"[pt] OR "psychometrics"[MeSH] OR psychometr*[tiab] OR clinimetr*[tw] OR clinometr*[tw] OR "outcome assessment (health care)"[MeSH] OR "outcome assessment"[tiab] OR "outcome measure*" [tw] OR "observer variation"[MeSH] OR "observer variation"[tiab] OR "Health Status Indicators"[Mesh] OR "reproducibility of results"[MeSH] OR reproducib*[tiab] OR "discriminant analysis"[MeSH] OR reliab*[tiab] OR unreliab*[tiab] OR valid*[tiab] OR "coefficient of variation"[tiab] OR coefficient[tiab] OR homogeneity[tiab] OR homogeneous[tiab] OR "internal consistency"[tiab] OR (cronbach*[tiab] AND (alpha[tiab] OR alphas[tiab])) OR (item[tiab] AND (correlation*[tiab] OR selection*[tiab] OR reduction*[tiab])) OR agreement[tw] OR precision[tw] OR imprecision[tw] OR "precise values"[tw] OR test-retest[tiab] OR (test[tiab] AND retest[tiab]) OR (reliab*[tiab] AND (test[tiab] OR retest[tiab])) OR stability[tiab] OR interrater[tiab] OR inter-rater[tiab] OR intrarater[tiab] OR intra-rater[tiab] OR intertester[tiab] OR inter-tester[tiab] OR intratester[tiab] OR intra-tester[tiab] OR interobserver[tiab] OR inter-observer[tiab] OR intraobserver[tiab] OR intra-observer[tiab] OR intertechnician[tiab] OR inter-technician[tiab] OR intratechnician[tiab] OR intra-technician[tiab] OR interexaminer[tiab] OR inter-examiner[tiab] OR

		<p>intraexaminer[tiab] OR intra-examiner[tiab] OR interassay[tiab] OR inter-assay[tiab] OR intraassay[tiab] OR intra-assay[tiab] OR interindividual[tiab] OR inter-individual[tiab] OR intraindividual[tiab] OR intra-individual[tiab] OR interparticipant[tiab] OR inter-participant[tiab] OR intraparticipant[tiab] OR intra-participant[tiab] OR kappa[tiab] OR kappa's[tiab] OR kappas[tiab] OR repeatab*[tw] OR ((replicab*[tw] OR repeated[tw]) AND (measure[tw] OR measures[tw] OR findings[tw] OR result[tw] OR results[tw] OR test[tw] OR tests[tw])) OR generaliza*[tiab] OR generalisa*[tiab] OR concordance[tiab] OR (intraclass[tiab] AND correlation*[tiab]) OR discriminative[tiab] OR "known group"[tiab] OR "factor analysis"[tiab] OR "factor analyses"[tiab] OR "factor structure"[tiab] OR "factor structures"[tiab] OR dimension*[tiab] OR subscale*[tiab] OR (multitrait[tiab] AND scaling[tiab] AND (analysis[tiab] OR analyses[tiab])) OR "item discriminant"[tiab] OR "interscale correlation*" [tiab] OR error[tiab] OR errors[tiab] OR "individual variability"[tiab] OR "interval variability"[tiab] OR "rate variability"[tiab] OR (variability[tiab] AND (analysis[tiab] OR values[tiab])) OR (uncertainty[tiab] AND (measurement[tiab] OR measuring[tiab])) OR "standard error of measurement"[tiab] OR sensitiv*[tiab] OR responsive*[tiab] OR (limit[tiab] AND detection[tiab]) OR "minimal detectable concentration"[tiab] OR interpretab*[tiab] OR ((minimal[tiab] OR minimally[tiab] OR clinical[tiab] OR clinically[tiab]) AND (important[tiab] OR significant[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR (small*[tiab] AND (real[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR "meaningful change"[tiab] OR "ceiling effect"[tiab] OR "floor effect"[tiab] OR "Item response model"[tiab] OR IRT[tiab] OR Rasch[tiab] OR "Differential item functioning"[tiab] OR DIF[tiab] OR "computer adaptive testing"[tiab] OR "item bank"[tiab] OR "cross-cultural equivalence"[tiab])</p>
6	#6	<p>("addresses"[Publication Type] OR "biography"[Publication Type] OR "case reports"[Publication Type] OR "comment"[Publication Type] OR "directory"[Publication Type] OR "editorial"[Publication Type] OR "festschrift"[Publication Type] OR "interview"[Publication Type] OR "lectures"[Publication Type] OR "legal cases"[Publication Type] OR "legislation"[Publication Type] OR "letter"[Publication Type] OR "news"[Publication Type] OR "newspaper article"[Publication Type] OR "patient education handout"[Publication Type] OR "popular works"[Publication Type] OR "congresses"[Publication Type] OR "consensus development conference"[Publication Type] OR "consensus development conference, nih"[Publication Type] OR "practice guideline"[Publication Type]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms])</p>
7	#7	#1 AND #2 AND #3 AND #4 AND #5 NOT #6

Note: "\*" to include all derivatives of that word or concept.

Table S2. Search strategy for Chinese databases

1	#1	TKA = 护理 OR TKA = 护士 OR TKA = 护生
2	#2	TKA = 健康教育能力 OR TKA = 患者教育能力 OR TKA = 健康教育胜任力 OR TKA = 患者教育胜任力
3	#3	SU = 评估 OR SU = 测量 OR SU = 评价 OR SU = 收集 OR SU = 调查 OR SU = 工具 OR SU = 问卷 OR SU = 量表 OR SU = 仪器 OR SU = 研究
4	#4	TKA = 信度 OR TKA = 效度 OR TKA = 反应度 OR TKA = 内部一致性 OR TKA = 稳定性 OR TKA = 相关系数 OR TKA = 克朗巴赫系数 OR TKA = 探索性因子分析 OR TKA = 验证性因子分析 OR TKA = 探索性因素分析 OR TKA = 验证性因素分析 OR TKA = 检验 OR TKA = 结果
5	#5	#1 AND #2 AND #3 AND #4

Note: TKA = title/abstract; SU = title/abstract/keywords.

Table S3. Characteristics of the included instruments

<b>Instrument name</b>	<b>Developer(s)/ year developed</b>	<b>Construct (s)</b>	<b>Target population</b>	<b>Mode of administration</b>	<b>Recall period</b>	<b>(Sub)scale (s) (number of items)</b>	<b>Response options</b>	<b>Range of scores/scoring</b>	<b>Original language</b>	<b>Available translations</b>

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Table S4. Characteristics of the included study populations

Instrument	Ref	Population			Instrument administration			Response rate
		N	Age Mean (SD, range) yr	Gender % female	Setting	Country	Language	
A	1							
	2							
	3							
B	1							

For peer review only

Table S5. Rating the measurement properties of the instruments

Instrument	Study 1			Study 2			Study 3			OVERALL						
	RATING	RATING	RATING	RATING	RATING	RATING	RATING	RATING	RATING	OVERALL RATING	OVERALL RATING	OVERALL RATING	QUALITY OF EVIDENCE	QUALITY OF EVIDENCE	QUALITY OF EVIDENCE	
	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	High, moderate, low, very low	High, moderate, low, very low	High, moderate, low, very low
	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	
Structural validity																
internal consistency																
Cross-cultural validity																
Measurement invariance																
Reliability																
Measurement error																
Criterion validity																
Construct validity																
Responsiveness																

Note: "+" = sufficient; "-" = insufficient; "?" = indeterminate.

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Table S5-1. Rating of the content validity of instruments

Instrument (Reference – study type/Rating of reviewers)	Content Validity													
	Relevance <sup>1</sup>					Comprehensiveness <sup>1</sup>		Comprehensibility <sup>1</sup>					CONTENT VALIDITY RATING <sup>2</sup>	
	1. Are the included items relevant for the construct of interest?	2. Are the included items relevant for the target population of interest?	3. Are the included items relevant for the context of use of interest?	4. Are the response options appropriate?	5. Is the recall period appropriate?	RELEVANCE RATING <sup>2</sup>	6. Are all key concepts included?	COMPREHENSIVENESS RATING <sup>2</sup>	7. Are the PROM instructions understood by the population of interest as intended?	8. Are the PROM items and response options understood by the population of interest as intended?	9. Are the PROM items appropriately worded?	10. Do the response options match the question?		COMPREHENSIBILITY RATING <sup>2</sup>
A (Ref 1- instrument development study)														
A (Ref 2 - Content validity study)														
A (Ref 3 - Content validity study)														
Rating of reviewers														
B (Ref 1- instrument development study)														
B (Ref 2 - Content validity study)														
Rating of reviewers														

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.....														
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Note:1. Rating for the 10 criteria for relevance, comprehensiveness, comprehensibility can be + / - /± / ? : ‘ + ’= sufficient, ‘ - ’= insufficient, ‘±’ = inconsistent, ‘?’ =indeterminate.

2. The RELEVANCE, COMPREHENSIVENESS, COMPREHESIBILITY, AND CONTENT VALIDITY rating can be + / - /± / ? : ‘ + ’= sufficient, ‘ - ’= insufficient, ‘±’ = inconsistent, ‘?’ =indeterminate.

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Table S6. Information on interpretability of instruments

Instrument (ref)		Percentage of missing items and percentage of missing total scores	Floor and ceiling effects	Scores and change scores available for relevant (sub)groups	Minimal important change (MIC) or minimal important difference (MID)	Information on response shift
Instrument A (ref 1)						
Instrument A (ref 2)						
Instrument A (ref 3)						
Instrument B (ref 1)						
.....						

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Table S7. Information on feasibility of instruments

Feasibility aspects	Instrument A	Instrument B	Instrument C	Instrument D
Patient's comprehensibility				
Clinician's comprehensibility				
Type and ease of administration				
Length of the instrument				
Completion time				
Patient's required mental and physical ability level				
Ease of standardization				
Ease of score calculation				
Copyright				
Cost of an instrument				
Required equipment				
Availability in different settings				
Regulatory agency's requirement for approval				

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Table S8. Quality<sup>1</sup> of studies on measurement properties

Instrument	Content validity <sup>2</sup>					Structural validity	Internal consistency	Cross-cultural validity	Reliability	Measurement error	Criterion validity	Convergent validity
	Asking patients			Asking experts								
	Relevance	Comprehensiveness	Comprehensibility	Relevance	Comprehensiveness							
A												
B												
.....												

Note: 1. Quality: V = very good, A = adequate, D = doubtful, I = inadequate.

2. Given that the criteria and rating systems for evaluating the content validity of instruments are different from those for other measurement properties, the quality results of content validity are not included in this table but separately shown in following Table S8-1.

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Table S8-1. Quality<sup>1</sup> of the instrument development

Instrument	PROM design						Cognitive interview (CI) study <sup>3</sup>				TOTAL PROM DEVELOPMENT	
	General design requirements					Concept elicitation <sup>2</sup>	Total PROM design	General design requirements	Comprehensibility	Comprehensiveness		Total CI study
	Clear construct	Clear origin of construct	Clear target population for which the PROM was developed	Clear context of use	PROM developed in sample representing the target population							
A												
B												
.....												

Note: 1. Quality: V = very good, A = adequate, D = doubtful, I = inadequate.

2. The concept elicitation will not be further rated if the instrument(s) was not developed in the sample representing the target population.

3. Empty cells indicate that a CI study (or part of it) was not performed.

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Table S9. Quality of the evidence for measurement properties of the instruments (Summary of findings)

Instrument	Content validity		Structural validity		Internal consistency		Cross-cultural validity		Reliability		Measurement error		Criterion validity		Hypotheses testing		Responsiveness	
	Overall Rating <sup>1</sup>	Quality of Evidence <sup>3</sup>	Overall Rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>
Instrument A																		
Instrument B																		
Instrument C																		
.....																		

Note:1. Overall ratings for the content validity (relevance, comprehensiveness, comprehensibility) can only be + / - /±: ‘+’= sufficient, ‘-’= insufficient, ‘±’ = inconsistent.

2. Overall ratings for other measurement properties can be + / - /±/?: ‘+’= sufficient, ‘-’= insufficient, ‘±’ = inconsistent, ‘?’ =indeterminate.

3. Ratings for quality of evidence: High, Moderate, Low, Very low.

# Reporting checklist for systematic review (with or without a meta-analysis).

Based on the PRISMA guidelines.

## Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMA reporting guidelines, and cite them as:

Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews

		Reporting Item	Page Number
<b>Title</b>			
Title	<a href="#">#1</a>	Identify the report as a systematic review	1
<b>Abstract</b>			
Abstract	<a href="#">#2</a>	Report an abstract addressing each item in the PRISMA 2020 for Abstracts checklist	1
<b>Introduction</b>			
Background/rationale	<a href="#">#3</a>	Describe the rationale for the review in the context of existing knowledge	3
Objectives	<a href="#">#4</a>	Provide an explicit statement of the objective(s) or question(s) the review addresses	5
<b>Methods</b>			



1	Eligibility criteria	<a href="#">#5</a>	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses	6
2				
3				
4	Information sources	<a href="#">#6</a>	Specify all databases, registers, websites, organisations, reference lists, and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted	6
5				
6				
7				
8				
9				
10	Search strategy	<a href="#">#7</a>	Present the full search strategies for all databases, registers, and websites, including any filters and limits used	6
11				
12				
13				
14	Selection process	<a href="#">#8</a>	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and, if applicable, details of automation tools used in the process	7
15				
16				
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18				
19				
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21				
22	Data collection process	<a href="#">#9</a>	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and, if applicable, details of automation tools used in the process	7
23				
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29				
30	Data items	<a href="#">#10a</a>	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (for example, for all measures, time points, analyses), and, if not, the methods used to decide which results to collect	7
31				
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38				
39	Study risk of bias assessment	<a href="#">#11</a>	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and, if applicable, details of automation tools used in the process	8
40				
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44				
45				
46	Effect measures	<a href="#">#12</a>	Specify for each outcome the effect measure(s) (such as risk ratio, mean difference) used in the synthesis or presentation of results	N/A
47				
48				
49	Synthesis methods	<a href="#">#13a</a>	Describe the processes used to decide which studies were eligible for each synthesis (such as tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5))	8
50				
51				
52				
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55				
56	Synthesis methods	<a href="#">#13b</a>	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics or data	N/A
57				
58				
59				
60				

1		conversions	
2	Synthesis methods	<a href="#">#13c</a> Describe any methods used to tabulate or visually display results of individual studies and syntheses	8
3			
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5			
6	Synthesis methods	<a href="#">#13d</a> Describe any methods used to synthesise results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used	9
7			
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12			
13	Synthesis methods	<a href="#">#13e</a> Describe any methods used to explore possible causes of heterogeneity among study results (such as subgroup analysis, meta-regression)	N/A
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15			
16			
17			
18	Synthesis methods	<a href="#">#13f</a> Describe any sensitivity analyses conducted to assess robustness of the synthesised results	N/A
19			
20			
21			
22	Reporting bias assessment	<a href="#">#14</a> Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases)	N/A
23			
24			
25			
26	Certainty assessment	<a href="#">#15</a> Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome	9
27			
28			
29			
30	Data items	<a href="#">#10b</a> List and define all other variables for which data were sought (such as participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information	7
31			
32			
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35			
36			
37	<b>Results</b>		
38			
39	Study selection	<a href="#">#16a</a> Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram ( <a href="http://www.prisma-statement.org/PRISMAStatement/FlowDiagram">http://www.prisma-statement.org/PRISMAStatement/FlowDiagram</a> )	N/A
40			
41			
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46			
47	Study selection	<a href="#">#16b</a> Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded	N/A
48			
49			
50			
51	Study characteristics	<a href="#">#17</a> Cite each included study and present its characteristics	N/A
52			
53			
54	Risk of bias in studies	<a href="#">#18</a> Present assessments of risk of bias for each included study	N/A
55			
56	Results of individual studies	<a href="#">#19</a> For all outcomes, present for each study (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its	N/A
57			
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1			precision (such as confidence/credible interval), ideally using	
2			structured tables or plots	
3				
4	Results of syntheses	<a href="#">#20a</a>	For each synthesis, briefly summarise the characteristics and risk of	N/A
5			bias among contributing studies	
6				
7				
8	Results of syntheses	<a href="#">#20b</a>	Present results of all statistical syntheses conducted. If meta-	N/A
9			analysis was done, present for each the summary estimate and its	
10			precision (such as confidence/credible interval) and measures of	
11			statistical heterogeneity. If comparing groups, describe the direction	
12			of the effect	
13				
14				
15				
16	Results of syntheses	<a href="#">#20c</a>	Present results of all investigations of possible causes of	N/A
17			heterogeneity among study results	
18				
19				
20	Results of syntheses	<a href="#">#20d</a>	Present results of all sensitivity analyses conducted to assess the	N/A
21			robustness of the synthesised results	
22				
23				
24	Risk of reporting	<a href="#">#21</a>	Present assessments of risk of bias due to missing results (arising	N/A
25	biases in syntheses		from reporting biases) for each synthesis assessed	
26				
27				
28	Certainty of evidence	<a href="#">#22</a>	Present assessments of certainty (or confidence) in the body of	N/A
29			evidence for each outcome assessed	
30				
31	<b>Discussion</b>			
32				
33				
34	Results in context	<a href="#">#23a</a>	Provide a general interpretation of the results in the context of other	N/A
35			evidence	
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38	Limitations of included	<a href="#">#23b</a>	Discuss any limitations of the evidence included in the review	N/A
39	studies			
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41				
42	Limitations of the	<a href="#">#23c</a>	Discuss any limitations of the review processes used	N/A
43	review methods			
44				
45	Implications	<a href="#">#23d</a>	Discuss implications of the results for practice, policy, and future	10
46			research	
47				
48				
49	<b>Other information</b>			
50				
51	Registration and	<a href="#">#24a</a>	Provide registration information for the review, including register	6
52	protocol		name and registration number, or state that the review was not	
53			registered	
54				
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56				
57	Registration and	<a href="#">#24b</a>	Indicate where the review protocol can be accessed, or state that a	6
58	protocol		protocol was not prepared	
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60				

1	Registration and	<a href="#">#24c</a>	Describe and explain any amendments to information provided at	N/A
2	protocol		registration or in the protocol	
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4				
5	Support	<a href="#">#25</a>	Describe sources of financial or non-financial support for the	11
6			review, and the role of the funders or sponsors in the review	
7				
8				
9	Competing interests	<a href="#">#26</a>	Declare any competing interests of review authors	11
10				
11	Availability of data,	<a href="#">#27</a>	Report which of the following are publicly available and where they	11
12	code, and other		can be found: template data collection forms; data extracted from	
13	materials		included studies; data used for all analyses; analytic code; any other	
14			materials used in the review	
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18 The PRISMA checklist is distributed under the terms of the Creative Commons Attribution License CC-BY.  
19 This checklist was completed on 16. February 2023 using <https://www.goodreports.org/>, a tool made by the  
20 [EQUATOR Network](#) in collaboration with [Penelope.ai](#)  
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# BMJ Open

## Instruments for measuring patient health education competence among nursing personnel: Protocol for a COSMIN-based systematic review

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3 **1 Instruments for measuring patient health education competence among nursing**  
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5 **2 personnel: Protocol for a COSMIN-based systematic review**  
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55 24 **ABSTRACT**  
56

57 25 **Introduction** Health education, as a crucial strategic measure of disease prevention and  
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1 control in the 21st century, has become an important part of healthcare. As the main  
2 deliverers of patient health education, nursing personnel's patient health education  
3 competence (PHEC) has received much attention. Instruments for assessing the PHEC  
4 of nursing personnel have been developed internationally, but there is a lack of  
5 systematic reviews and evaluations of the psychometric properties of these instruments.  
6 To effectively select appropriate PHEC assessment instruments in specific contexts, a  
7 systematic and comprehensive review and evaluation of these measurement instruments  
8 are needed. The goal of this systematic review is to systematically evaluate the  
9 psychometric properties of existing PHEC instruments.

10 **Methods and analysis** In this study, eight databases will be searched between March  
11 1, 2023, and March 31, 2023, to retrieve studies that include instrument(s) measuring  
12 the PHEC of nursing personnel. Two researchers will independently perform literature  
13 screening, data extraction, and literature evaluation. In case of disagreement, a third  
14 researcher will be involved in the resolution. The measurement properties of PHEC  
15 assessment instruments will be systematically reviewed based on the consensus-based  
16 standards for the selection of health measurement instruments (COMSIN) methodology  
17 and guideline.

18 **Ethics and dissemination** Ethical approval is not applicable for this study. We will  
19 share the findings from the study at national and/or international conferences and in a  
20 peer-reviewed journal in the fields of health education and/or patient education.

21 **PROSPERO registration number** CRD42023393293

## 22 **Strengths and limitations of this study**

23 ➤ The Preferred Reporting Items for Systematic Reviews and Meta-analyses  
24 protocols (PRISMA-P) 2015 checklist and the Preferred Reporting Items for  
25 Systematic Reviews and Meta-analyses (PRISMA) 2020 checklist will be used to

- 1 guide the reporting of the protocol and systematic review, respectively.
- 2
- 3
- 4
- 5
- 6 ➤ The consensus-based standards for the selection of health measurement
- 7
- 8 instruments (COSMIN) methodology will be used to evaluate the methodological
- 9
- 10 quality of included studies on measurement properties of the instruments and the
- 11
- 12 quality of included instruments.
- 13
- 14 ➤ The systematic review may fail to include relevant literature published outside of
- 15
- 16 the searched databases.
- 17
- 18

## 19 1. INTRODUCTION

20

21 Health education has been identified by the World Health Organization (WHO) as

22

23 one of the three crucial strategic measures of disease prevention and control in the 21st

24

25 century, and it is the most economical and effective measure for improving public

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27 health.[1] Health education for patients can improve their understanding of their own

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29 health status and disease management measures, which can relieve patients' anxiety

30

31 and improve their compliance and satisfaction with medical staff, thus improving their

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33 health status and quality of life.[2] These better patient outcomes could reduce the

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35 burden of disease on patients and society at the economic level.[3,4] As the world's

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37 largest group of health professionals and the health professionals who have the closest

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39 contact with patients, nursing staff plays an important role in patient health

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41 education.[3,5] Nurses often develop profound connections with their patients,

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43 rendering them optimal conveyors of health information and proponents of constructive

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45 behavioral transformations.[6] Their consistent and sustained patient interactions afford

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47 them an intimate grasp of individual needs, preferences, and hurdles, enabling the

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49 delivery of tailored patient health education that accommodates these divergent

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51 factors.[6,7] This education encompasses instructing patients on health preservation,

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53 preventive measures, and autonomous health management. Consequently, patients are

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3 1 empowered to make enlightened choices and enhance compliance with treatment  
4  
5 2 regimens. Functioning as integral healthcare team members, nurses proficiently  
6  
7 3 facilitate intercommunication among patients, physicians, and allied healthcare  
8  
9 4 professionals.[8] Their adeptness at translating medical jargon and disseminating  
10  
11 5 information empowers patients to comprehend medical language, thereby expediting  
12  
13 6 the formulation and execution of efficacious treatment strategies.[7] Therefore, nurses  
14  
15 7 have an integral and important role in patient health education.  
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18  
19 8 Patient health education competency (PHEC) refers to the specific qualities that  
20  
21 9 health educators should have to conduct effective health education activities with  
22  
23 10 patients.[9,10] PHEC is an essential professional competency for nursing staff and  
24  
25 11 determines the quality of patient education.[11-14] However, in existing studies, the  
26  
27 12 PHEC of clinical nurses is often the lowest-rated area of nursing competency.[15,16]  
28  
29 13 Therefore, the development and strengthening of PHEC for nurses are extremely  
30  
31 14 important to improve the quality of patient education, patient care, patient safety, and  
32  
33 15 the development of nursing careers. In addition, we should pay attention to nursing  
34  
35 16 students' PHEC because they are the primary reserve of the clinical nurse workforce.  
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40 17 Accurate measurement of PHEC is important because it can be used to assess the  
41  
42 18 PHEC status of nursing personnel and to develop targeted strategies based on the  
43  
44 19 nursing personnel's PHEC. Moreover, it can be used in research to assess the  
45  
46 20 effectiveness of relevant PHEC interventions. Currently, relevant measurement  
47  
48 21 instruments have been developed internationally: for example, a scale for measuring  
49  
50 22 the PHEC of registered nurses developed by Lin et al. in 2017,[17] a PHEC competency  
51  
52 23 assessment scale developed by Hwang et al. based on a literature review and the Delphi  
53  
54 24 method,[18] and a Spanish version of the nurse PHEC scale developed by Pueyo-  
55  
56 25 Garrigues et al.[19] Although related instruments are available for assessing PHEC in  
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3 1 nursing personnel, these evaluation instruments have been developed in different  
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5 2 settings and their validation varies considerably, with none considered the gold standard.  
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8 3 In this study, we defined PHEC as the specific qualities that must be possessed by  
9  
10 4 health educators to provide health education to patients, including knowledge, skills,  
11  
12 5 beliefs or attitudes, self-concept, personality qualities, and motivation. Although there  
13  
14 6 has been a review of PHEC measurement instruments for nursing staff, this review has  
15  
16 7 some limitations on its rigor.[20] First, this review included not only measurement  
17  
18 8 instruments for PHEC but also systems for evaluating PHEC, which are different from  
19  
20 9 measurement instruments. Second, this review did not systematically evaluate the  
21  
22 10 measurement properties of instruments for measuring PHEC based on related  
23  
24 11 guidelines. However, a systematic and comprehensive review of PHEC measurement  
25  
26 12 instruments is crucial for guiding the selection of instruments and/or guiding the  
27  
28 13 development and refinement of high-quality instruments in the future. The consensus-  
29  
30 14 based standards for the selection of health measurement instruments (COSMIN)  
31  
32 15 methodology provides resources to systematically review measurement instruments  
33  
34 16 and evaluate them in terms of both methodological quality and quality of measurement  
35  
36 17 properties to select instruments that are of high quality for study purposes and provide  
37  
38 18 an evidence-based foundation for future high-level instrument development.[21]  
39  
40 19 Eskolin et al. conducted a review on instruments assessing nurses' competence in the  
41  
42 20 empowerment of patient education.[22] However, in this review, the author did not give  
43  
44 21 a clear and specific definition of 'empowering patient education competence of nurses'.  
45  
46 22 This may lead to an unclear research boundary. Their investigation encompassed not  
47  
48 23 only instruments appraising nurses' PHEC but also instruments evaluating the quality  
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50 24 of patient education provided by healthcare professionals. Furthermore, they included  
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52 25 tools for measuring nurses' attitudes toward patient education. Considering the  
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1 importance of nursing personnel in patient health education, and to ensure a more  
2 distinct scope and targeted content, our study will focus specifically on the PHEC  
3 measurement instruments, which are designed specifically for nursing personnel,  
4 including both nurses and nursing students. Furthermore, in our review, we will  
5 incorporate Chinese databases, unveiling more qualified instruments that align with our  
6 stringent criteria. Thus, this study is designed to conduct a comprehensive and rigorous  
7 systematic review of PHEC assessment instruments based on the COSMIN  
8 methodology, to evaluate the measurement properties of these instruments, provide a  
9 reference for nursing personnel and researchers to accurately and effectively assess  
10 PHEC, and provide recommendations for researchers to develop and improve PHEC  
11 assessment instruments.

12 This systematic review will address the following questions: (1) What instruments  
13 are available for assessing the PHEC of nursing personnel? (2) What are the  
14 characteristics of these instruments? (3) What is the methodological quality of studies  
15 on the measurement properties of these instruments? (4) What are these instruments'  
16 measurement properties, interpretability, and feasibility? (5) What are the similarities  
17 and differences between these instruments? (6) What are the knowledge and research  
18 gaps in the assessment of PHEC of nursing personnel?

## 19 **2. METHODS**

20 The COSMIN guideline for systematic reviews of PROMs will be used to guide  
21 the implementation of the systematic review. PRISMA-P 2015 checklist and PRISMA  
22 2020 checklist will be used to guide the reporting of the protocol and systematic review,  
23 respectively.[21,23,24] We registered the protocol in the International Prospective  
24 Register of Systematic Reviews (PROSPERO, CRD42023393293).

### 25 **Inclusion and exclusion criteria of studies**

## 1 **Inclusion criteria**

2 Studies will be included if they (1) address instrument(s) for measuring the PHEC  
3 of nurses or nursing students, (2) describe the processes of development and evaluation  
4 of one or more measurement properties for eligible instrument(s), (3) discuss  
5 instruments designed to measure the PHEC of health professionals (the literature  
6 explicitly mentions that it applies to nursing personnel as well), and (4) have full-text  
7 availability. If full-text versions of the studies are not available online, the authors of  
8 these articles will be contacted, and articles for which valid information was not  
9 available after contacting the authors will be excluded.

## 10 **Exclusion criteria**

11 Studies will be excluded if they are (1) not primary studies (e.g., biographies,  
12 addresses, and editorials) or are case studies, (2) reports that used the instruments only  
13 for outcome measurements, (3) secondary studies (e.g., reviews and/or systematic  
14 reviews), or (4) duplicate published studies.

## 15 **Search strategy**

16 A systematic search will be performed between March 1, 2023, and March 31, 2023,  
17 in six English databases (i.e., CINAHL, EMBASE, Ovid Medline, PubMed, PsycINFO,  
18 and Web of Science) and two Chinese databases (i.e., CNKI and WANFANG DATA).  
19 We include Chinese databases since the researchers speak Chinese as their native  
20 language. We will also search for and screen references of all eligible literature. The  
21 search time limit is from the library's creation date to the search date. A literature search  
22 will be conducted using a combination of subject terms and free words. The major  
23 search concepts will be nursing, health education, competence, instrument, and  
24 measurement properties. Related comprehensive and sensitive search strategies  
25 developed by other researchers will also be used in this literature search, including (1)

1 the search filter developed by the University of Oxford for finding PROMs,[25] (2) the  
2 sensitive PubMed search filter for measuring attributes developed by Terwee et al., and  
3 (3) corresponding search filters applicable to other databases.[26] We will examine  
4 results reported by nurses or nursing students, so the first filter will be adjusted  
5 appropriately (e.g., we will remove those sections that are relevant to the quality of life  
6 and patient-reported outcomes). The search strategy constructed for PubMed is  
7 described in Table S1 in the supplementary file. The search strategy for the Chinese  
8 databases is shown in Table S2 in the supplementary file.

### 9 **Study screening**

10 Covidence will be used to manage the references.[27] First, duplicates from the  
11 eight databases will be removed with Covidence. After the initial screening, both  
12 researchers will independently review and screen titles, abstracts, and full-text articles  
13 with the support of Covidence. In case of disagreement, a third researcher will be  
14 consulted to screen the literature. The screening processes of this study are shown in  
15 Figure 1.

### 16 **Data extraction**

17 The two researchers will independently extract data from the included papers and  
18 resolve their differences through discussion. We will extract the data about the  
19 characteristics of the instruments (including instrument name, developer[s]/year  
20 developed, construct[s], targeted population, mode of administration, recall period,  
21 [sub]scale[s]/[number of items], response options, range of scores/scoring, original  
22 language, and available translations; see Table S3 in the supplementary file), the  
23 characteristics of the included populations (including sample size, mean of age, gender,  
24 setting, country, and language; see Table S4 in the supplementary file.), the results on  
25 the psychometric properties (Table S5 in the supplementary file), and information about

1 the interpretability (Table S6 in the supplementary file) and feasibility (Table S7 in the  
2 supplementary file) of the included instruments.

3 The term ‘outcome measure instrument development’ will be used instead of the  
4 original ‘patient-reported outcome measure development’ to more accurately reflect the  
5 inclusion of studies that examined outcomes reported by nurses or nursing students  
6 rather than patients.

### 7 **Quality appraisal and Data synthesis**

8 Two researchers will independently assess the quality of eligible studies using the  
9 COSMIN Risk of Bias checklist, which is divided into three sections: content validity  
10 (instrument development and content validity), internal structure (structural validity,  
11 internal consistency, and cross-cultural validity/measurement invariance), and other  
12 measurement properties (reliability, measurement error, criterion validity, hypothesis  
13 testing for construct validity, and responsiveness).[21,23,28] Each measurement  
14 property will be evaluated by different items provided by the COSMIN Risk of Bias  
15 checklist, and the items will be rated on a five-level score of ‘very good’, ‘adequate’,  
16 ‘doubtful’, ‘inadequate’, or ‘not applicable.’[23,28] Based on the ‘the worst score  
17 counts’ principle, each measurement property’s overall methodological quality score is  
18 expressed by taking the lowest rating of any standard in the box.[23,29] Subsequently,  
19 the two researchers will apply the updated criteria for good measurement properties  
20 alone to evaluate the reliability and validity of the instruments themselves, and the  
21 quality of the evidence will be graded using the Grading of Recommendations  
22 Assessment, Development, and Evaluation (GRADE) approach.[23,29] In case of  
23 disagreement, a third researcher will be consulted.

24 We will work according to the following three steps. In the first step, two  
25 investigators will apply the COSMIN Risk of Bias checklist to evaluate the

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2  
3 1 methodological quality of each eligible study individually.[28] The final consensus on  
4  
5 2 the results of the methodological quality will be presented in Tables S8 and S8-1 in the  
6  
7 3 supplementary file. In the second step, the updated criteria for good measurement  
8  
9 4 properties will be applied to evaluate the quality of evidence for each measured property,  
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11 5 and the evaluation results will be shown in Tables S5 and S5-1 in the supplementary  
12  
13 6 file.[23,29] This section mainly evaluates the strengths and weaknesses of the  
14  
15 7 measurement properties. Among these, the quality of content validity will be evaluated  
16  
17 8 according to the COSMIN methodology for content validity in three aspects: the  
18  
19 9 relevance, comprehensiveness, and comprehensibility of items, which can be ‘sufficient  
20  
21 10 (+)’, ‘insufficient (-)’, ‘indeterminate (?)’, or ‘inconsistent ( $\pm$ )’.[29,30] The quality of  
22  
23 11 the remaining measurement properties (structural validity, internal consistency, cross-  
24  
25 12 cultural validity, measurement invariance, reliability, measurement error, criterion  
26  
27 13 validity, construct validity, and responsiveness) will be evaluated by applying the  
28  
29 14 COSMIN quality criteria, which can be ‘sufficient (+)’, ‘insufficient (-)’, and  
30  
31 15 ‘indeterminate (?)’.[23] The corresponding results will be reported in the rating  
32  
33 16 columns of Table S5 in the supplementary file, and the results of rating content validity  
34  
35 17 will be presented separately in Table S5-1 in the supplementary file. In the third step, a  
36  
37 18 modified GRADE approach will be used to rate the quality of the above evidence,  
38  
39 19 reflecting the level of confidence in the quality of the evidence. To evaluate the  
40  
41 20 content’s validity, three of these factors are applicable: risk of bias, inconsistency, and  
42  
43 21 indirectness.[29] Assuming that the level of evidence quality for each of the remaining  
44  
45 22 measurement properties is high, the quality of the evidence will be downgraded by  
46  
47 23 considering the following factors: risk of bias, inconsistency, imprecision, and  
48  
49 24 indirectness.[23] The quality of evidence will be divided into four levels: ‘high’,  
50  
51 25 ‘moderate’, ‘low’, or ‘very low’.[21,23] The corresponding results will be displayed in  
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3 1 Table S9 in the supplementary file. Two investigators will independently grade and  
4  
5 2 cross-check the results. In case of disputes, final decisions will be made in consultation  
6  
7 3 with the third investigator.  
8  
9

#### 10 4 **Patient and public involvement**

11  
12 5 Neither patients nor the public will be involved in this study.  
13  
14

#### 15 6 **Ethics and dissemination**

16  
17 7 Ethical approval is not applicable for this study. We will share the findings from  
18  
19 8 the study at national and/or international conferences and in a peer-reviewed journal in  
20  
21 9 the fields of health education and/or patient education.  
22  
23

### 24 10 **3. DISCUSSION**

25  
26 11 To our knowledge, this will be the first COSMIN-based systematic review of  
27  
28 12 PHEC assessment instruments for nursing personnel , which will be reported following  
29  
30 13 the Preferred Reporting Items for Systematic Reviews and Meta-analyses protocols  
31  
32 14 (PRISMA-P) 2020 checklist. This systematic review will provide a comprehensive  
33  
34 15 rating of the level of evidence for each measurement property of the PHEC assessment  
35  
36 16 instruments, which will be based on an evaluation of the measurement properties of all  
37  
38 17 included instruments and the methodological quality of the studies. Through this study,  
39  
40 18 we will be able to develop recommendations on the use of existing qualified instruments  
41  
42 19 in clinical practice and research that could assist nursing personnel and researchers in  
43  
44 20 the accurate and valid assessment of PHEC. This review may provide an evidence-  
45  
46 21 based foundation for the development, design, validation, and use of future instruments  
47  
48 22 by identifying problems in instrument development and validation and therefore help  
49  
50 23 researchers to develop and improve these instruments.  
51  
52  
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58 25 **Author contributions** All authors have read and agreed to the published version of the  
59  
60



1 manuscript.

2 Conceptualization: QC, ST, SW;

3 Methodology: QC, ST, ZS;

4 Data curation: QC, SW, KL;

5 Writing—original draft preparation: SW, KL, QC;

6 Writing—review and editing: QC, ST, ZS;

7 Supervision: QC and ST.

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9 China (No. 72104250) and the Natural Science Foundation of Hunan Province (No.  
10 2022JJ40642).

11 **Competing interests** None declared.

12 **Patient consent** Not required.

13 **Data sharing statement** No additional data available.

14  
15 **List of Figures:**

16 Figure 1. Flowchart of literature selection process

17 **List of Supplementary File Tables:**

18 Table S1. Search strategy for PubMed

19 Table S2. Search strategy for Chinese database

20 Table S3. Characteristics of the included instrument

21 Table S4. Characteristics of the included study population

22 Table S5: Rating the measurement properties of the instruments

23 Table S5-1: Rating of the content validity of instruments

24 Table S6: Information on interpretability of instruments

25 Table S7: Information on feasibility of instruments

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2  
3 1 Table S8: Quality of studies on measurement properties  
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5 2 Table S8-1: Quality of the instrument development  
6

7 3 Table S9: Quality of the evidence for measurement properties of the instruments  
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11  
12 **References:**  
13

- 14 1. Organization WH. Health education: theoretical concepts, effective strategies and  
15 core competencies: a foundation document to guide capacity development of health  
16 educators. 2012. Available from:  
17 [https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB\\_2012\\_EN\\_13](https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB_2012_EN_13)  
18 [62.pdf?sequen](https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB_2012_EN_13)  
19  
20 2. Turner A, Anderson JK, Wallace LM, et al. An evaluation of a self-management  
21 program for patients with long-term conditions. *Patient Educ Couns*  
22 2015;98(2):213-9. doi: 10.1016/j.pec.2014.08.022.  
23  
24 3. Lin P, Gao C, Su S, et al. Teaching principles: The applications in nursing practice.  
25 *Taipei: Farseeing*. 2005.  
26  
27 4. Siegel KR, Ali MK, Zhou X, et al. Cost-effectiveness of interventions to manage  
28 diabetes: has the evidence changed since 2008? *Diabetes Care* 2020;43(7):1557-  
29 92. doi: 10.2337/dci20-0017.  
30  
31 5. Koutsopoulou S, Papathanassoglou ED, Katapodi MC, et al. Nurses as information  
32 providers to cancer patients: Critical review of the evidence. *J Clin Nurs*  
33 2010;19(5-6):749-65. doi: 10.1111/j.1365-2702.2009.02954.x.  
34  
35 6. Feo R, Rasmussen P, Wiechula R, et al. Developing effective and caring nurse-  
36 patient relationships. *Nurs Stand* 2017;31(28):54-63. doi: 10.7748/ns.2017.e10735  
37  
38 7. Kwame A, Petrucka PM. A literature-based study of patient-centered care and  
39 communication in nurse-patient interactions: barriers, facilitators, and the way  
40  
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- 1 forward. *BMC Nurs* 2021;20(1):158. doi: 10.1186/s12912-021-00684-2
- 2
- 3 1 forward. *BMC Nurs* 2021;20(1):158. doi: 10.1186/s12912-021-00684-2
- 4
- 5 8. Ghiyasvandian S, Zakerimoghadam M, Peyravi H. Nurse as a facilitator to
- 6 professional communication: a qualitative study. *Glob J Health Sci* 2014;7(2):294-
- 7 303. doi: 10.5539/gjhs.v7n2p294
- 8
- 9 9. Hwang H-L, Kuo T-Y. Competency in delivering health education: A concept
- 10 analysis. *J Interprof Educ Pract* 2018;11:20-5. doi:
- 11 <https://doi.org/10.1016/j.xjep.2018.02.005>
- 12
- 13 10. Karimi Moonaghi H, Emami Zeydi A, Mirhaghi A. Patient education among nurses:
- 14 bringing evidence into clinical applicability in Iran. *Invest Educ Enferm*
- 15 2016;34(1):137-51. doi: 10.17533/udea.iee.v34n1a16.
- 16
- 17 11. Flinkman M, Leino-Kilpi H, Numminen O, et al. Nurse Competence Scale: a
- 18 systematic and psychometric review. *J Adv Nurs* 2017;73(5):1035-50. doi:
- 19 10.1111/jan.13183.
- 20
- 21 12. Ko Y, Yu S. Core nursing competency assessment tool for graduates of
- 22 outcome-based nursing education in South Korea: A validation study. *Jpn J Nurs*
- 23 *Sci* 2019;16(2):155-71. doi: 10.1111/jjns.12223.
- 24
- 25 13. Nilsson J, Engström M, Florin J, et al. A short version of the nurse professional
- 26 competence scale for measuring nurses' self-reported competence. *Nurse Educ*
- 27 *Today* 2018;71:233-9. doi: 10.1016/j.nedt.2018.09.028.
- 28
- 29 14. Wilkinson CA. Competency assessment tools for registered nurses: An integrative
- 30 review. *J Contin Educ Nurs* 2013;44(1):31-7. doi: 10.3928/00220124-20121101-
- 31 53.
- 32
- 33 15. Cowan DT, Wilson-Barnett DJ, Norman IJ, et al. Measuring nursing competence:
- 34 Development of a self-assessment tool for general nurses across Europe. *Int J Nurs*
- 35 *Stud* 2008;45(6):902-13. doi: 10.1016/j.ijnurstu.2007.03.004.
- 36
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2  
3 16. Pueyo-Garrigues M, Whitehead D, Pardavila-Belio MI, et al. Health education: a  
4 Rogerian concept analysis. *Int J Nurs Stud* 2019;94:131-8. doi:  
5 10.1016/j.ijnurstu.2019.03.005.  
6  
7  
8  
9  
10 17. Lin LY, Wang RH. Patient Education Competence Scale for Registered Nurses in  
11 Taiwan: Scale development and psychometric validation. *Jpn J Nurs Sci*  
12 2017;14(2):117-25. doi: 10.1111/jjns.12141.  
13  
14  
15  
16  
17 18. Hwang HL, Kuo ML, Tu CT. Health education and competency scale:  
18 Development and testing. *J Clin Nurs* 2018;27(3-4):e658-e67. doi:  
19 10.1111/jocn.14116.  
20  
21  
22  
23  
24 19. Pueyo-Garrigues M, Pardavila-Belio MI, Whitehead D, et al. Nurses' knowledge,  
25 skills and personal attributes for competent health education practice: An  
26 instrument development and psychometric validation study. *J Adv Nurs*  
27 2021;77(2):715-28. doi: 10.1111/jan.14632.  
28  
29  
30  
31  
32  
33 20. Mi Y, Wu D, Wei ZZ, et al. Research progress on evaluation tool for health  
34 education competency of nursing staff. *Chinese Nursing Research*  
35 2020;34(11):1983-7.  
36  
37  
38  
39  
40 21. Prinsen CA, Mokkink LB, Bouter LM, et al. COSMIN guideline for systematic  
41 reviews of patient-reported outcome measures. *Qual Life Res* 2018;27:1147-57. doi:  
42 10.1007/s11136-018-1798-3.  
43  
44  
45  
46  
47 22. Eskolin SE, Inkeroinen S, Leino-Kilpi H, et al. Instruments for measuring  
48 empowering patient education competence of nurses: Systematic review. *J Adv*  
49 *Nurs* 2023;79(7):2414-28. doi: 10.1111/jan.15597  
50  
51  
52  
53  
54 23. Mokkink LB, Prinsen C, Patrick DL, et al. COSMIN methodology for systematic  
55 reviews of patient-reported outcome measures (PROMs). User manual.  
56 2018;78(1):6-63. Available from: <https://www.cosmin.nl/wp->  
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- 1  
2  
3 1 [content/uploads/COSMIN-syst-review-for-PROMs-manual\\_version-1\\_feb-2018-](#)  
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5 2 [1.pdf](#)  
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7  
8 3 24. Page MJ, Moher D, Bossuyt PM, et al. PRISMA 2020 explanation and elaboration:  
9  
10 4 updated guidance and exemplars for reporting systematic reviews. *BMJ* 2021;372.  
11  
12 5 doi: 10.1136/bmj.n160.  
13  
14 6 25. Mackintosh A, Comabella C, Hadi M, et al. PROM group construct & instrument  
15  
16 type filters. *Department of Public Health, University of Oxford, Oxford*. 2010.  
17  
18 Available from: [https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-](https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-2010.pdf)  
19  
20 8 [2010.pdf](https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-2010.pdf)  
21  
22 9  
23  
24 10 26. Terwee CB, Jansma EP, Riphagen II, et al. Development of a methodological  
25  
26 11 PubMed search filter for finding studies on measurement properties of  
27  
28 12 measurement instruments. *Qual Life Res* 2009;18:1115-23. doi: 10.1007/s11136-  
29  
30 13 009-9528-5.  
31  
32  
33 14 27. Babineau J. Product review: Covidence (systematic review software). *Journal of*  
34  
35 15 *the Canadian Health Libraries Association/Journal de l'Association des*  
36  
37 16 *bibliothèques de la santé du Canada* 2014;35(2):68-71.  
38  
39  
40 17 28. Mokkink LB, De Vet HC, Prinsen CA, et al. COSMIN risk of bias checklist for  
41  
42 18 systematic reviews of patient-reported outcome measures. *Qual Life Res*  
43  
44 19 2018;27:1171-9. doi: 10.1007/s11136-017-1765-4.  
45  
46  
47 20 29. Terwee CB, Prinsen C, Chiarotto A, et al. COSMIN methodology for assessing the  
48  
49 21 content validity of PROMs–user manual. *Amsterdam: VU University Medical*  
50  
51 22 *Center*. 2018. Available from: [https://cosmin.nl/wp-content/uploads/COSMIN-](https://cosmin.nl/wp-content/uploads/COSMIN-methodology-for-content-validity-user-manual-v1.pdf)  
52  
53 23 [methodology-for-content-validity-user-manual-v1.pdf](https://cosmin.nl/wp-content/uploads/COSMIN-methodology-for-content-validity-user-manual-v1.pdf)  
54  
55  
56  
57 24 30. Terwee CB, Prinsen CA, Chiarotto A, et al. COSMIN methodology for evaluating  
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1           the content validity of patient-reported outcome measures: a Delphi study. *Qual*  
2           *Life Res* 2018;27:1159-70. doi: 10.1007/s11136-018-1829-0.

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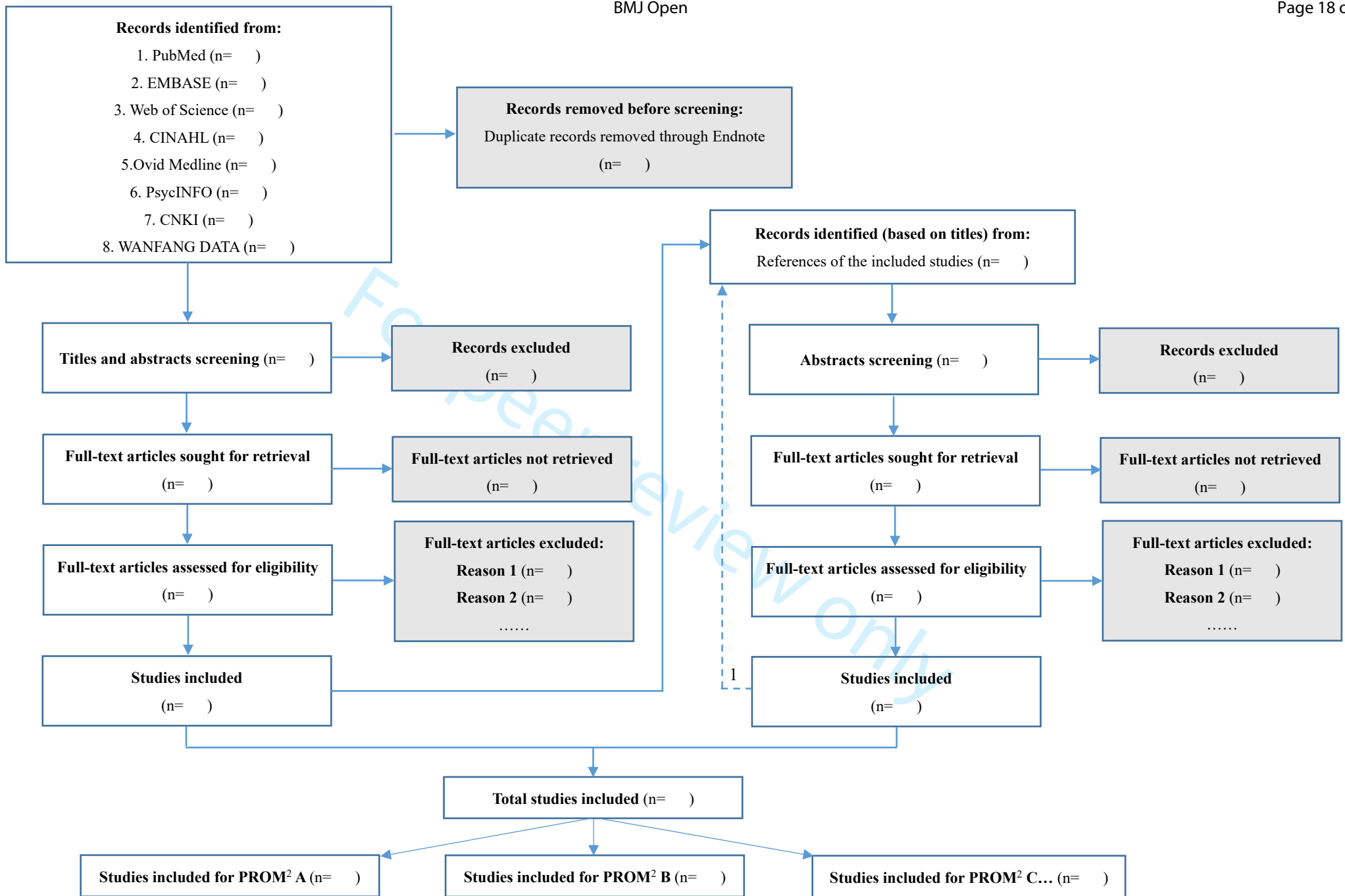


Figure 1. Flowchart of literature selection process

Note: 1. References of all included studies will be manually screened until no eligible studies can be identified.

2. PROM: patient-reported outcome measure.

Table S1. Search strategy for PubMed

1	#1	nurs*
2	#2	((((((((Health Education[Mesh] OR Patient Education as Topic[Mesh]) OR (health education*[tiab])) OR (education, health[tiab])) OR (patient education*[tiab])) OR (education program*[tiab])) OR (educational program*[tiab])) OR (education, patient*[tiab])) OR (education of patient*[tiab])) OR (nursing education*[tiab])) OR (hospital education*[tiab])) OR (educational activit*[tiab])) OR ((educat*[tiab]) AND (individual patient*[tiab]))
3	#3	((((((((professional competence[MeSH]) OR (professional competence[tiab])) OR (competence, professional[tiab])) OR (generalization of expertise[tiab])) OR (expertise generalization[tiab])) OR (technical expertise[tiab])) OR (expertise, technical[tiab])) OR (competenc*[tiab] OR capabilit*[tiab] OR capacit*[tiab] OR abilit*[tiab])) OR ((skill*[tiab] OR belief[tiab] OR attitude[tiab]) AND (knowledge[tiab]))
4	#4	(report[tiab] OR reported[tiab] OR reporting[tiab] OR rated[tiab] OR rating[tiab] OR ratings[tiab] OR based[tiab] OR assessed[tiab] OR assessment[tiab] OR assessments[tiab] OR disability[tiab] OR function[tiab] OR functional[tiab] OR functions[tiab] OR subjective[tiab] OR utility[tiab] OR utilities[tiab] OR wellbeing[tiab] OR well being[tiab]) AND (index[tiab] OR indices[tiab] OR instrument[tiab] OR instruments[tiab] OR measure[tiab] OR measures[tiab] OR questionnaire[tiab] OR questionnaires[tiab] OR profile[tiab] OR profiles[tiab] OR scale[tiab] OR scales[tiab] OR score[tiab] OR scores[tiab] OR status[tiab] OR survey[tiab] OR surveys[tiab])
5	#5	(instrumentation[sh] OR methods[sh] OR "Validation Studies"[pt] OR "Comparative Study"[pt] OR "psychometrics"[MeSH] OR psychometr*[tiab] OR clinimetr*[tw] OR clinometr*[tw] OR "outcome assessment (health care)"[MeSH] OR "outcome assessment"[tiab] OR "outcome measure*" [tw] OR "observer variation"[MeSH] OR "observer variation"[tiab] OR "Health Status Indicators"[Mesh] OR "reproducibility of results"[MeSH] OR reproducib*[tiab] OR "discriminant analysis"[MeSH] OR reliab*[tiab] OR unreliab*[tiab] OR valid*[tiab] OR "coefficient of variation"[tiab] OR coefficient[tiab] OR homogeneity[tiab] OR homogeneous[tiab] OR "internal consistency"[tiab] OR (cronbach*[tiab] AND (alpha[tiab] OR alphas[tiab])) OR (item[tiab] AND (correlation*[tiab] OR selection*[tiab] OR reduction*[tiab])) OR agreement[tw] OR precision[tw] OR imprecision[tw] OR "precise values"[tw] OR test-retest[tiab] OR (test[tiab] AND retest[tiab]) OR (reliab*[tiab] AND (test[tiab] OR retest[tiab])) OR stability[tiab] OR interrater[tiab] OR inter-rater[tiab] OR intrarater[tiab] OR intra-rater[tiab] OR intertester[tiab] OR inter-tester[tiab] OR intratester[tiab] OR intra-tester[tiab] OR interobserver[tiab] OR inter-observer[tiab] OR intraobserver[tiab] OR intra-observer[tiab] OR intertechnician[tiab] OR inter-technician[tiab] OR intratechnician[tiab] OR intra-technician[tiab] OR interexaminer[tiab] OR inter-examiner[tiab] OR intraexaminer[tiab] OR intra-examiner[tiab] OR interassay[tiab] OR inter-



		<p>assay[tiab] OR intraassay[tiab] OR intra-assay[tiab] OR interindividual[tiab] OR inter-individual[tiab] OR intraindividual[tiab] OR intra-individual[tiab] OR interparticipant[tiab] OR inter-participant[tiab] OR intraparticipant[tiab] OR intra-participant[tiab] OR kappa[tiab] OR kappa's[tiab] OR kappas[tiab] OR repeatab*[tw] OR ((replicab*[tw] OR repeated[tw]) AND (measure[tw] OR measures[tw] OR findings[tw] OR result[tw] OR results[tw] OR test[tw] OR tests[tw])) OR generaliza*[tiab] OR generalisa*[tiab] OR concordance[tiab] OR (intraclass[tiab] AND correlation*[tiab]) OR discriminative[tiab] OR "known group"[tiab] OR "factor analysis"[tiab] OR "factor analyses"[tiab] OR "factor structure"[tiab] OR "factor structures"[tiab] OR dimension*[tiab] OR subscale*[tiab] OR (multitrait[tiab] AND scaling[tiab] AND (analysis[tiab] OR analyses[tiab])) OR "item discriminant"[tiab] OR "interscale correlation*" [tiab] OR error[tiab] OR errors[tiab] OR "individual variability"[tiab] OR "interval variability"[tiab] OR "rate variability"[tiab] OR (variability[tiab] AND (analysis[tiab] OR values[tiab])) OR (uncertainty[tiab] AND (measurement[tiab] OR measuring[tiab])) OR "standard error of measurement"[tiab] OR sensitiv*[tiab] OR responsive*[tiab] OR (limit[tiab] AND detection[tiab]) OR "minimal detectable concentration"[tiab] OR interpretab*[tiab] OR ((minimal[tiab] OR minimally[tiab] OR clinical[tiab] OR clinically[tiab]) AND (important[tiab] OR significant[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR (small*[tiab] AND (real[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR "meaningful change"[tiab] OR "ceiling effect"[tiab] OR "floor effect"[tiab] OR "Item response model"[tiab] OR IRT[tiab] OR Rasch[tiab] OR "Differential item functioning"[tiab] OR DIF[tiab] OR "computer adaptive testing"[tiab] OR "item bank"[tiab] OR "cross-cultural equivalence"[tiab])</p>
6	#6	<p>("addresses"[Publication Type] OR "biography"[Publication Type] OR "case reports"[Publication Type] OR "comment"[Publication Type] OR "directory"[Publication Type] OR "editorial"[Publication Type] OR "festschrift"[Publication Type] OR "interview"[Publication Type] OR "lectures"[Publication Type] OR "legal cases"[Publication Type] OR "legislation"[Publication Type] OR "letter"[Publication Type] OR "news"[Publication Type] OR "newspaper article"[Publication Type] OR "patient education handout"[Publication Type] OR "popular works"[Publication Type] OR "congresses"[Publication Type] OR "consensus development conference"[Publication Type] OR "consensus development conference, nih"[Publication Type] OR "practice guideline"[Publication Type]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms])</p>
7	#7	#1 AND #2 AND #3 AND #4 AND #5 NOT #6

Note: "\*" to include all derivatives of that word or concept.

Table S2. Search strategy for Chinese databases

1	#1	TKA = 护理 OR TKA = 护士 OR TKA = 护生
2	#2	TKA = 健康教育能力 OR TKA = 患者教育能力 OR TKA = 健康教育胜任力 OR TKA = 患者教育胜任力
3	#3	SU = 评估 OR SU = 测量 OR SU = 评价 OR SU = 收集 OR SU = 调查 OR SU = 工具 OR SU = 问卷 OR SU = 量表 OR SU = 仪器 OR SU = 研究
4	#4	TKA = 信度 OR TKA = 效度 OR TKA = 反应度 OR TKA = 内部一致性 OR TKA = 稳定性 OR TKA = 相关系数 OR TKA = 克朗巴赫系数 OR TKA = 探索性因子分析 OR TKA = 验证性因子分析 OR TKA = 探索性因素分析 OR TKA = 验证性因素分析 OR TKA = 检验 OR TKA = 结果
5	#5	#1 AND #2 AND #3 AND #4

Note: TKA = title/abstract; SU = title/abstract/keywords.

Table S3. Characteristics of the included instruments

Instrument name	Developer(s)/ year developed	Construct (s)	Target population	Mode of administration	Recall period	(Sub)scale (s) (number of items)	Response options	Range of scores/scoring	Original language	Available translations

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Table S4. Characteristics of the included study populations

Instrument	Ref	Population			Instrument administration			Response rate
		N	Age Mean (SD, range) yr	Gender % female	Setting	Country	Language	
A	1							
	2							
	3							
B	1							

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Table S5. Rating the measurement properties of the instruments

Instrument	Study 1			Study 2			Study 3			OVERALL					
	RATING	RATING	RATING	RATING	RATING	RATING	RATING	RATING	RATING	OVERALL RATING	OVERALL RATING	OVERALL RATING	QUALITY OF EVIDENCE	QUALITY OF EVIDENCE	QUALITY OF EVIDENCE
	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	High, moderate, low, very low	High, moderate, low, very low	High, moderate, low, very low
	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus
Structural validity															
internal consistency															
Cross-cultural validity															
Measurement invariance															
Reliability															
Measurement error															
Criterion validity															
Construct validity															
Responsiveness															

Note: "+" = sufficient; "-" = insufficient; "?" = indeterminate.

Table S5-1. Rating of the content validity of instruments

Instrument (Reference – study type/Rating of reviewers)	Content Validity													
	Relevance <sup>1</sup>					Comprehensiveness <sup>1</sup>		Comprehensibility <sup>1</sup>					CONTENT VALIDITY RATING <sup>2</sup>	
	1. Are the included items relevant for the construct of interest?	2. Are the included items relevant for the target population of interest?	3. Are the included items relevant for the context of use of interest?	4. Are the response options appropriate?	5. Is the recall period appropriate?	RELEVANCE RATING <sup>2</sup>	6. Are all key concepts included?	COMPREHENSIVENESS RATING <sup>2</sup>	7. Are the PROM instructions understood by the population of interest as intended?	8. Are the PROM items and response options understood by the population of interest as intended?	9. Are the PROM items appropriately worded?	10. Do the response options match the question?	COMPREHENSIBILITY RATING <sup>2</sup>	
A (Ref 1- instrument development study)														
A (Ref 2 - Content validity study)														
A (Ref 3 - Content validity study)														
Rating of reviewers														
B (Ref 1- instrument development study)														
B (Ref 2 - Content validity study)														
Rating of reviewers														

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Note:1. Rating for the 10 criteria for relevance, comprehensiveness, comprehensibility can be + / - /± / ? : ‘ + ’= sufficient, ‘ - ’= insufficient, ‘±’ = inconsistent, ‘?’ =indeterminate.  
 2. The RELEVANCE, COMPREHENSIVENESS, COMPREHESIBILITY, AND CONTENT VALIDITY rating can be + / - /± / ? : ‘ + ’= sufficient, ‘ - ’= insufficient, ‘±’ = inconsistent, ‘?’ =indeterminate.

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Table S6. Information on interpretability of instruments

Instrument (ref)		Percentage of missing items and percentage of missing total scores	Floor and ceiling effects	Scores and change scores available for relevant (sub)groups	Minimal important change (MIC) or minimal important difference (MID)	Information on response shift
Instrument A (ref 1)						
Instrument A (ref 2)						
Instrument A (ref 3)						
Instrument B (ref 1)						
.....						

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Table S7. Information on feasibility of instruments

Feasibility aspects	Instrument A	Instrument B	Instrument C	Instrument D
Patient's comprehensibility				
Clinician's comprehensibility				
Type and ease of administration				
Length of the instrument				
Completion time				
Patient's required mental and physical ability level				
Ease of standardization				
Ease of score calculation				
Copyright				
Cost of an instrument				
Required equipment				
Availability in different settings				
Regulatory agency's requirement for approval				

Table S8. Quality<sup>1</sup> of studies on measurement properties

Instrument	Content validity <sup>2</sup>				Structural validity	Internal consistency	Cross-cultural validity	Reliability	Measurement error	Criterion validity	Convergent validity
	Asking patients		Asking experts								
	Relevance	Comprehensiveness	Comprehensibility	Relevance							
A											
B											
.....											

Note: 1. Quality: V = very good, A = adequate, D = doubtful, I = inadequate.

2. Given that the criteria and rating systems for evaluating the content validity of instruments are different from those for other measurement properties, the quality results of content validity are not included in this table but separately shown in following Table S8-1.

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Table S8-1. Quality<sup>1</sup> of the instrument development

Instrument	PROM design						Cognitive interview (CI) study <sup>3</sup>				TOTAL PROM DEVELOPMENT	
	General design requirements					Concept elicitation <sup>2</sup>	Total PROM design	General design requirements	Comprehensibility	Comprehensiveness		Total CI study
	Clear construct	Clear origin of construct	Clear target population for which the PROM was developed	Clear context of use	PROM developed in sample representing the target population							
A												
B												
.....												

Note: 1. Quality: V = very good, A = adequate, D = doubtful, I = inadequate.

2. The concept elicitation will not be further rated if the instrument(s) was not developed in the sample representing the target population.

3. Empty cells indicate that a CI study (or part of it) was not performed.

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Table S9. Quality of the evidence for measurement properties of the instruments (Summary of findings)

Instrument	Content validity		Structural validity		Internal consistency		Cross-cultural validity		Reliability		Measurement error		Criterion validity		Hypotheses testing		Responsiveness	
	Overall Rating <sup>1</sup>	Quality of Evidence <sup>3</sup>	Overall Rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>
Instrument A																		
Instrument B																		
Instrument C																		
.....																		

Note:1. Overall ratings for the content validity (relevance, comprehensiveness, comprehensibility) can only be + / - /±: ‘+’= sufficient, ‘-’= insufficient, ‘±’= inconsistent.

2. Overall ratings for other measurement properties can be + / - /± / ? : ‘+’= sufficient, ‘-’= insufficient, ‘±’= inconsistent, ‘?’=indeterminate.

3. Ratings for quality of evidence: High, Moderate, Low, Very low.

**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol\***

Section and topic	Item No	Checklist item	Pg.
<b>ADMINISTRATIVE INFORMATION</b>			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Pg. 1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	Pg. 2 and Pg. 6
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Pg. 1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Pg. 11-12
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Pg. 12
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
<b>INTRODUCTION</b>			
Rationale	6	Describe the rationale for the review in the context of what is already known	Pg. 3-6
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Pg. 6
<b>METHODS</b>			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Pg. 7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Pg. 7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	Supplemental file
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Pg. 8

1				
2				
3	Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Pg. 8
4				
5	Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Pg. 8-9 Supplemental file
6				
7	Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Pg. 8-9 Supplemental file
8				
9	Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Pg. 8-9 Supplemental file
10				
11	Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	Pg. 9
12				
13	Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/A
14		15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$ , Kendall's $\tau$ )	N/A
15		15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/A
16		15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Pg. 10
17				
18	Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/A
19				
20	Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	Pg. 9-10
21				

**\* It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

*From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.*

# BMJ Open

## Instruments for measuring patient health education competence among nursing personnel: Protocol for a COSMIN-based systematic review

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3 **1 Instruments for measuring patient health education competence among nursing**  
4  
5 **2 personnel: Protocol for a COSMIN-based systematic review**  
6

7  
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46  
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49

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53 23  
54

55 24 **ABSTRACT**  
56

57 25 **Introduction** Health education, as a crucial strategic measure of disease prevention and  
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1 control in the 21st century, has become an important part of health care. As the main  
2 deliverers of patient health education, nursing personnel's patient health education  
3 competence (PHEC) has received much attention. Instruments for assessing the PHEC  
4 of nursing personnel have been developed internationally, but there is a lack of  
5 systematic reviews and evaluations of the psychometric properties of these instruments.  
6 To effectively select appropriate PHEC assessment instruments in specific contexts, a  
7 systematic and comprehensive review and evaluation of these measurement instruments  
8 are needed. The goal of this systematic review is to systematically evaluate the  
9 psychometric properties of existing PHEC instruments.

10 **Methods and analysis** In this study, eight databases will be searched between March  
11 1, 2023, and March 31, 2023, to retrieve studies that include instrument(s) measuring  
12 the PHEC of nursing personnel. Two researchers will independently perform literature  
13 screening, data extraction, and literature evaluation. In case of disagreement, a third  
14 researcher will be involved in the resolution. The measurement properties of PHEC  
15 assessment instruments will be systematically reviewed based on the consensus-based  
16 standards for the selection of health measurement instruments (COMSIN) methodology  
17 and guideline.

18 **Ethics and dissemination** Ethical approval is not applicable for this study. We will  
19 share the findings from the study at national and/or international conferences and in a  
20 peer-reviewed journal in the fields of health education and/or patient education.

21 **PROSPERO registration number** CRD42023393293

## 22 **Strengths and limitations of this study**

23 ➤ The Preferred Reporting Items for Systematic Reviews and Meta-analyses  
24 protocols (PRISMA-P) 2015 checklist and the Preferred Reporting Items for  
25 Systematic Reviews and Meta-analyses (PRISMA) 2020 checklist will be used to

- 1 guide the reporting of the protocol and systematic review, respectively.
- 2
- 3
- 4
- 5
- 6 2 ➤ The consensus-based standards for the selection of health measurement
- 7
- 8 3 instruments (COSMIN) methodology will be used to evaluate the methodological
- 9
- 10 4 quality of included studies on measurement properties of the instruments and the
- 11
- 12 5 quality of included instruments.
- 13
- 14 6 ➤ The systematic review may fail to include relevant literature published outside of
- 15
- 16 7 the searched databases.
- 17
- 18

## 19 8 **1. INTRODUCTION**

20

21 Health education has been identified by the World Health Organization (WHO) as

22

23 one of the three crucial strategic measures of disease prevention and control in the 21st

24

25 century, and it is the most economical and effective measure for improving public

26

27 health.[1] Health education for patients can improve their understanding of their own

28

29 health status and disease management measures, which can relieve patients' anxiety

30

31 and improve their compliance and satisfaction with medical staff, thus improving their

32

33 health status and quality of life.[2] These better patient outcomes could reduce the

34

35 burden of disease on patients and society at the economic level.[3,4] As the world's

36

37 largest group of health professionals and the health professionals who have the closest

38

39 contact with patients, nursing staff plays an important role in patient health

40

41 education.[3,5] Nurses often develop profound connections with their patients,

42

43 rendering them optimal conveyors of health information and proponents of constructive

44

45 behavioral transformations.[6] Their consistent and sustained patient interactions afford

46

47 them an intimate grasp of individual needs, preferences, and hurdles, enabling the

48

49 delivery of tailored patient health education that accommodates these divergent

50

51 factors.[6,7] This education encompasses instructing patients on health preservation,

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53 preventive measures, and autonomous health management. Consequently, patients are

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1  
2  
3 1 empowered to make enlightened choices and enhance compliance with treatment  
4  
5 2 regimens. Functioning as integral health care team members, nurses proficiently  
6  
7 3 facilitate intercommunication among patients, physicians, and allied health care  
8  
9 4 professionals.[8] Their adeptness at translating medical jargon and disseminating  
10  
11 5 information empowers patients to comprehend medical language, thereby expediting  
12  
13 6 the formulation and execution of efficacious treatment strategies.[7] Therefore, nurses  
14  
15 7 have an integral and important role in patient health education.  
16  
17

18  
19 8 Patient health education competency (PHEC) refers to the specific qualities that  
20  
21 9 health educators should have to conduct effective health education activities with  
22  
23 10 patients.[9,10] PHEC is an essential professional competency for nursing staff and  
24  
25 11 determines the quality of patient education.[11-14] However, in existing studies, the  
26  
27 12 PHEC of clinical nurses is often the lowest-rated area of nursing competency.[15,16]  
28  
29 13 Therefore, the development and strengthening of PHEC for nurses are extremely  
30  
31 14 important to improve the quality of patient education, patient care, patient safety, and  
32  
33 15 the development of nursing careers. In addition, we should pay attention to nursing  
34  
35 16 students' PHEC because they are the primary reserve of the clinical nurse workforce.  
36  
37

38  
39 17 Accurate measurement of PHEC is important because it can be used to assess the  
40  
41 18 PHEC status of nursing personnel and to develop targeted strategies based on the  
42  
43 19 nursing personnel's PHEC. Moreover, it can be used in research to assess the  
44  
45 20 effectiveness of relevant PHEC interventions. Currently, relevant measurement  
46  
47 21 instruments have been developed internationally: for example, a scale for measuring  
48  
49 22 the PHEC of registered nurses developed by Lin et al. in 2017,[17] a PHEC competency  
50  
51 23 assessment scale developed by Hwang et al. based on a literature review and the Delphi  
52  
53 24 method,[18] and a Spanish version of the nurse PHEC scale developed by Pueyo-  
54  
55 25 Garrigues et al.[19] Although related instruments are available for assessing PHEC in  
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2  
3 1 nursing personnel, these evaluation instruments have been developed in different  
4  
5 2 settings and their validation varies considerably, with none considered the gold standard.  
6  
7

8 3 In this study, we defined PHEC as the specific qualities that must be possessed by  
9  
10 4 nursing personnel to provide health education to patients, including knowledge, skills,  
11  
12 5 beliefs or attitudes, self-concept, personality qualities, and motivation. Although there  
13  
14 6 has been a review of PHEC measurement instruments for nursing staff, this review has  
15  
16 7 some limitations on its rigor.[20] First, this review included not only measurement  
17  
18 8 instruments for PHEC but also systems for evaluating PHEC, which are different from  
19  
20 9 measurement instruments. Second, this review did not systematically evaluate the  
21  
22 10 measurement properties of instruments for measuring PHEC based on related  
23  
24 11 guidelines. However, a systematic and comprehensive review of PHEC measurement  
25  
26 12 instruments is crucial for guiding the selection of instruments and/or guiding the  
27  
28 13 development and refinement of high-quality instruments in the future. The consensus-  
29  
30 14 based standards for the selection of health measurement instruments (COSMIN)  
31  
32 15 methodology provides resources to systematically review measurement instruments  
33  
34 16 and evaluate them in terms of both methodological quality and quality of measurement  
35  
36 17 properties to select instruments that are of high quality for study purposes and provide  
37  
38 18 an evidence-based foundation for future high-level instrument development.[21]  
39  
40 19 Eskolin et al. conducted a review on instruments assessing nurses' competence in the  
41  
42 20 empowerment of patient education.[22] However, in this review, the author did not give  
43  
44 21 a clear and specific definition of 'empowering patient education competence of nurses'.  
45  
46 22 This may lead to an unclear research boundary. Their investigation encompassed not  
47  
48 23 only instruments appraising nurses' PHEC but also instruments evaluating the quality  
49  
50 24 of patient education provided by health care professionals. Furthermore, they included  
51  
52 25 tools for measuring nurses' attitudes toward patient education. Considering the  
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1 importance of nursing personnel in patient health education, and to ensure a more  
2 distinct scope and targeted content, our study will focus specifically on the PHEC  
3 measurement instruments, which are designed specifically for nursing personnel,  
4 including both nurses and nursing students. Furthermore, in our review, we will  
5 incorporate Chinese databases, unveiling more qualified instruments that align with our  
6 stringent criteria. Thus, this study is designed to conduct a comprehensive and rigorous  
7 systematic review of PHEC assessment instruments based on the COSMIN  
8 methodology, to evaluate the measurement properties of these instruments, provide a  
9 reference for nursing personnel and researchers to accurately and effectively assess  
10 PHEC, and provide recommendations for researchers to develop and improve PHEC  
11 assessment instruments.

12 This systematic review will address the following questions: (1) What instruments  
13 are available for assessing the PHEC of nursing personnel? (2) What are the  
14 characteristics of these instruments? (3) What is the methodological quality of studies  
15 on the measurement properties of these instruments? (4) What are these instruments'  
16 measurement properties, interpretability, and feasibility? (5) What are the similarities  
17 and differences between these instruments? (6) What are the knowledge and research  
18 gaps in the assessment of PHEC of nursing personnel?

## 19 **2. METHODS**

20 The COSMIN guideline for systematic reviews of PROMs will be used to guide  
21 the implementation of the systematic review. PRISMA-P 2015 checklist and PRISMA  
22 2020 checklist will be used to guide the reporting of the protocol and systematic review,  
23 respectively.[21,23,24] We registered the protocol in the International Prospective  
24 Register of Systematic Reviews (PROSPERO, CRD42023393293). The inconsistency  
25 between this protocol and that registered on PROSPERO and the reasons for this are

1  
2  
3 1 shown in Table S1.  
4

## 5 2 **Inclusion and exclusion criteria of studies**

### 6 3 **Inclusion criteria**

7  
8 4 Studies will be included if they (1) address instrument(s) for measuring the PHEC  
9  
10 of nurses or nursing students, (2) describe the processes of development and evaluation  
11  
12 of one or more measurement properties for eligible instrument(s), (3) discuss  
13  
14 instruments designed to measure the PHEC of health professionals (the literature  
15  
16 explicitly mentions that it applies to nursing personnel as well), and (4) have full-text  
17  
18 availability. If full-text versions of the studies are not available online, the authors of  
19  
20 these articles will be contacted, and articles for which valid information was not  
21  
22 available after contacting the authors will be excluded. We will limit the included  
23  
24 studies to those written in English and Chinese.  
25  
26  
27  
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29

### 30 13 **Exclusion criteria**

31  
32 14 Studies will be excluded if they are (1) not primary studies (e.g., biographies,  
33  
34 addresses, and editorials) or are case studies, (2) reports that used the instruments only  
35  
36 for outcome measurements, (3) secondary studies (e.g., reviews and/or systematic  
37  
38 reviews), or (4) duplicate published studies.  
39  
40  
41

### 42 18 **Search strategy**

43  
44 19 A systematic search will be performed between March 1, 2023, and March 31, 2023,  
45  
46 in six English databases (i.e., CINAHL, EMBASE, Ovid Medline, PubMed, PsycINFO,  
47  
48 and Web of Science) and two Chinese databases (i.e., CNKI and WANFANG DATA).  
49  
50 We include Chinese databases since the researchers speak Chinese as their native  
51  
52 language. We will also search for and screen references of all eligible literature. The  
53  
54 search time limit is from the library's creation date to March 31, 2023. A literature  
55  
56 search will be conducted using a combination of subject terms and free words. The  
57  
58  
59  
60

1 major search concepts will be nursing, health education, competence, instrument, and  
2 measurement properties. Related comprehensive and sensitive search strategies  
3 developed by other researchers will also be used in this literature search, including (1)  
4 the search filter developed by the University of Oxford for finding PROMs,[25] (2) the  
5 sensitive PubMed search filter for measuring attributes developed by Terwee et al., and  
6 (3) corresponding search filters applicable to other databases.[26] We will examine  
7 results reported by nurses or nursing students, so the first filter will be adjusted  
8 appropriately (e.g., we will remove those sections that are relevant to the quality of life  
9 and patient-reported outcomes). The search strategy constructed for PubMed is  
10 described in Table S2 in the supplementary file. The search strategy for the Chinese  
11 databases is shown in Table S3 in the supplementary file.

## 12 **Study screening**

13 Covidence will be used to manage the references.[27] First, duplicates from the  
14 eight databases will be removed with Covidence. After the initial screening, both  
15 researchers will independently review and screen titles, abstracts, and full-text articles  
16 with the support of Covidence. In case of disagreement, a third researcher will be  
17 consulted to screen the literature. The screening processes of this study are shown in  
18 Figure 1.

## 19 **Data extraction**

20 The two researchers will independently extract data from the included papers and  
21 resolve their differences through discussion. We will extract the data about the  
22 characteristics of the instruments (including instrument name, developer[s]/year  
23 developed, construct[s], targeted population, mode of administration, recall period,  
24 [sub]scale[s]/[number of items], response options, range of scores/scoring, original  
25 language, and available translations; see Table S4 in the supplementary file), the

1  
2  
3 1 characteristics of the included populations (including sample size, mean of age, gender,  
4  
5 2 setting, country, and language; see Table S5 in the supplementary file.), the results on  
6  
7 3 the psychometric properties (Table S6 in the supplementary file), and information about  
8  
9 4 the interpretability (Table S7 in the supplementary file) and feasibility (Table S8 in the  
10  
11 5 supplementary file) of the included instruments.  
12  
13

14  
15 6 The term ‘outcome measure instrument development’ will be used instead of the  
16  
17 7 original ‘patient-reported outcome measure development’ to more accurately reflect the  
18  
19 8 inclusion of studies that examined outcomes reported by nurses or nursing students  
20  
21 9 rather than patients.  
22  
23

## 24 10 **Quality appraisal and Data synthesis**

25  
26 11 Two researchers will independently assess the quality of eligible studies using the  
27  
28 12 COSMIN Risk of Bias checklist, which is divided into three sections: content validity  
29  
30 13 (instrument development and content validity), internal structure (structural validity,  
31  
32 14 internal consistency, and cross-cultural validity/measurement invariance), and other  
33  
34 15 measurement properties (reliability, measurement error, criterion validity, hypothesis  
35  
36 16 testing for construct validity, and responsiveness).[21,23,28] Each measurement  
37  
38 17 property will be evaluated by different items provided by the COSMIN Risk of Bias  
39  
40 18 checklist, and the items will be rated on a five-level score of ‘very good’, ‘adequate’,  
41  
42 19 ‘doubtful’, ‘inadequate’, or ‘not applicable.’[23,28] Based on the ‘the worst score  
43  
44 20 counts’ principle, each measurement property’s overall methodological quality score is  
45  
46 21 expressed by taking the lowest rating of any standard in the box.[23,29] Subsequently,  
47  
48 22 the two researchers will apply the updated criteria for good measurement properties  
49  
50 23 alone to evaluate the reliability and validity of the instruments themselves, and the  
51  
52 24 quality of the evidence will be graded using the Grading of Recommendations  
53  
54 25 Assessment, Development, and Evaluation (GRADE) approach.[23,29] In case of  
55  
56  
57  
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1 disagreement, a third researcher will be consulted.

2 We will work using the following three steps. In the first step, two investigators  
3 will apply the COSMIN Risk of Bias checklist to evaluate the methodological quality  
4 of each eligible study individually.[28] The final consensus on the results of the  
5 methodological quality will be presented in Tables S9 and S9-1 in the supplementary  
6 file. In the second step, the updated criteria for good measurement properties will be  
7 applied to evaluate the quality of evidence for each measured property, and the  
8 evaluation results will be shown in Tables S6 and S6-1 in the supplementary file.[23,29]  
9 This section mainly evaluates the strengths and weaknesses of the measurement  
10 properties. Among these, the quality of content validity will be evaluated according to  
11 the COSMIN methodology for content validity in three aspects: the relevance,  
12 comprehensiveness, and comprehensibility of items, which can be ‘sufficient (+)’,  
13 ‘insufficient (-)’, ‘indeterminate (?)’, or ‘inconsistent ( $\pm$ )’.[29,30] The quality of the  
14 remaining measurement properties (structural validity, internal consistency, cross-  
15 cultural validity, measurement invariance, reliability, measurement error, criterion  
16 validity, construct validity, and responsiveness) will be evaluated by applying the  
17 COSMIN quality criteria, which can be ‘sufficient (+)’, ‘insufficient (-)’, and  
18 ‘indeterminate (?)’.[23] The corresponding results will be reported in the rating  
19 columns of Table S6 in the supplementary file, and the results of rating content validity  
20 will be presented separately in Table S6-1 in the supplementary file. In the third step, a  
21 modified GRADE approach will be used to rate the quality of the above evidence,  
22 reflecting the level of confidence in the quality of the evidence. To evaluate the  
23 content’s validity, three of these factors are applicable: risk of bias, inconsistency, and  
24 indirectness.[29] Assuming that the level of evidence quality for each of the remaining  
25 measurement properties is high, the quality of the evidence will be downgraded by

1  
2  
3 1 considering the following factors: risk of bias, inconsistency, imprecision, and  
4  
5 2 indirectness.[23] The quality of evidence will be divided into four levels: 'high',  
6  
7 3 'moderate', 'low', or 'very low'. [21,23] The corresponding results will be displayed in  
8  
9 4 Table S10 in the supplementary file. Two investigators will independently grade and  
10  
11 5 cross-check the results. In case of disputes, final decisions will be made in consultation  
12  
13 6 with the third investigator.  
14  
15

### 17 **Patient and public involvement**

18  
19 8 Neither patients nor the public will be involved in this study.  
20  
21

### 22 **Ethics and dissemination**

23  
24 10 Ethical approval is not applicable for this study. We will share the findings from  
25  
26 11 the study at national and/or international conferences and in a peer-reviewed journal in  
27  
28 12 the fields of health education and/or patient education.  
29  
30

## 31 **3. DISCUSSION**

32  
33 14 To our knowledge, this will be the first COSMIN-based systematic review of  
34  
35 15 PHEC assessment instruments for nursing personnel , which will be reported following  
36  
37 16 the Preferred Reporting Items for Systematic Reviews and Meta-analyses protocols  
38  
39 17 (PRISMA-P) 2020 checklist. This systematic review will provide a comprehensive  
40  
41 18 rating of the level of evidence for each measurement property of the PHEC assessment  
42  
43 19 instruments, which will be based on an evaluation of the measurement properties of all  
44  
45 20 included instruments and the methodological quality of the studies. Through this study,  
46  
47 21 we will be able to develop recommendations on the use of existing qualified instruments  
48  
49 22 in clinical practice and research that could assist nursing personnel and researchers in  
50  
51 23 the accurate and valid assessment of PHEC. This review may provide an evidence-  
52  
53 24 based foundation for the development, design, validation, and use of future instruments  
54  
55 25 by identifying problems in instrument development and validation and therefore help  
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2  
3 1 researchers to develop and improve these instruments.  
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6 2

7  
8 3 **Author contributions** All authors have read and agreed to the published version of the  
9  
10 4 manuscript.

11  
12 5 Conceptualization: QC, ST, SW;

13  
14 6 Methodology: QC, ST, ZS;

15  
16 7 Data curation: QC, SW, KL;

17  
18 8 Writing—original draft preparation: SW, KL, QC;

19  
20 9 Writing—review and editing: QC, ST, ZS;

21  
22 10 Supervision: QC and ST.

23  
24  
25  
26 11 **Funding** This work was supported by the National Natural Science Foundation of  
27  
28 12 China (No. 72104250) and the Natural Science Foundation of Hunan Province (No.  
29  
30 13 2022JJ40642).

31  
32  
33 14 **Competing interests** None declared.

34  
35 15 **Patient consent** Not required.

36  
37 16 **Data sharing statement** No additional data available.  
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#### 18 **List of Figures:**

19 Figure 1. Flowchart of literature selection process

#### 20 **List of Supplementary File Tables:**

21 Table S1. Reasons for inconsistencies

22 Table S2. Search strategy for PubMed

23 Table S3. Search strategy for Chinese database

24 Table S4. Characteristics of the included instrument

25 Table S5. Characteristics of the included study population

- 1  
2  
3 1 Table S6: Rating the measurement properties of the instruments  
4  
5 2 Table S6-1: Rating of the content validity of instruments  
6  
7 3 Table S7: Information on interpretability of instruments  
8  
9  
10 4 Table S8: Information on feasibility of instruments  
11  
12 5 Table S9: Quality of studies on measurement properties  
13  
14 6 Table S9-1: Quality of the instrument development  
15  
16  
17 7 Table S10: Quality of the evidence for measurement properties of the instruments  
18  
19  
20 8

21  
22 **References:**

- 23  
24 1. Organization WH. Health education: theoretical concepts, effective strategies and  
25  
26 11 core competencies: a foundation document to guide capacity development of  
27  
28 12 health educators. 2012. Available from:  
29  
30 13 [https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB\\_2012\\_EN\\_13](https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB_2012_EN_13)  
31  
32 14 [62.pdf?sequen](https://apps.who.int/iris/bitstream/handle/10665/119953/EMRPUB_2012_EN_13) accessed September 11 2023.  
33  
34  
35 15 2. Turner A, Anderson JK, Wallace LM, et al. An evaluation of a self-management  
36  
37 16 program for patients with long-term conditions. *Patient Educ Couns*  
38  
39 17 2015;98(2):213-9. doi: 10.1016/j.pec.2014.08.022  
40  
41  
42 18 3. Lin P, Gao C, Su S, et al. Teaching principles: The applications in nursing  
43  
44 19 practice. *Taipei: Farseeing*. 2005.  
45  
46  
47 20 4. Siegel KR, Ali MK, Zhou X, et al. Cost-effectiveness of interventions to manage  
48  
49 21 diabetes: has the evidence changed since 2008? *Diabetes Care* 2020;43(7):1557-  
50  
51 22 92. doi: 10.2337/dci20-0017  
52  
53  
54 23 5. Koutsopoulou S, Papathanassoglou ED, Katapodi MC, et al. Nurses as  
55  
56 24 information providers to cancer patients: Critical review of the evidence. *J Clin*  
57  
58 25 *Nurs* 2010;19(5-6):749-65. doi: 10.1111/j.1365-2702.2009.02954.x  
59  
60

- 1 6. Feo R, Rasmussen P, Wiechula R, et al. Developing effective and caring nurse-  
2 patient relationships. *Nurs Stand* 2017;31(28):54-63. doi:  
3 10.7748/ns.2017.e10735
- 4 7. Kwame A, Petrucka PM. A literature-based study of patient-centered care and  
5 communication in nurse-patient interactions: barriers, facilitators, and the way  
6 forward. *BMC Nurs* 2021;20(1):158. doi: 10.1186/s12912-021-00684-2
- 7 8. Ghiyasvandian S, Zakerimoghadam M, Peyravi H. Nurse as a facilitator to  
8 professional communication: a qualitative study. *Glob J Health Sci*  
9 2014;7(2):294-303. doi: 10.5539/gjhs.v7n2p294
- 10 9. Hwang H-L, Kuo T-Y. Competency in delivering health education: A concept  
11 analysis. *J Interprof Educ Pract* 2018;11:20-5. doi:  
12 <https://doi.org/10.1016/j.xjep.2018.02.005>
- 13 10. Karimi Moonaghi H, Emami Zeydi A, Mirhaghi A. Patient education among  
14 nurses: bringing evidence into clinical applicability in Iran. *Invest Educ Enferm*  
15 2016;34(1):137-51. doi: 10.17533/udea.iee.v34n1a16
- 16 11. Flinkman M, Leino-Kilpi H, Numminen O, et al. Nurse Competence Scale: a  
17 systematic and psychometric review. *J Adv Nurs* 2017;73(5):1035-50. doi:  
18 10.1111/jan.13183
- 19 12. Ko Y, Yu S. Core nursing competency assessment tool for graduates of  
20 outcome-based nursing education in South Korea: A validation study. *Jpn J Nurs*  
21 *Sci* 2019;16(2):155-71. doi: 10.1111/jjns.12223
- 22 13. Nilsson J, Engström M, Florin J, et al. A short version of the nurse professional  
23 competence scale for measuring nurses' self-reported competence. *Nurse Educ*  
24 *Today* 2018;71:233-9. doi: 10.1016/j.nedt.2018.09.028

25

- 1  
2  
3 14. Wilkinson CA. Competency assessment tools for registered nurses: An  
4  
5 integrative review. *J Contin Educ Nurs* 2013;44(1):31-7. doi: 10.3928/00220124-  
6  
7 20121101-53  
8  
9  
10 15. Cowan DT, Wilson-Barnett DJ, Norman IJ, et al. Measuring nursing competence:  
11  
12 Development of a self-assessment tool for general nurses across Europe. *Int J*  
13  
14 *Nurs Stud* 2008;45(6):902-13. doi: 10.1016/j.ijnurstu.2007.03.004  
15  
16  
17 16. Pueyo-Garrigues M, Whitehead D, Pardavila-Belio MI, et al. Health education: a  
18  
19 Rogerian concept analysis. *Int J Nurs Stud* 2019;94:131-8. doi:  
20  
21 10.1016/j.ijnurstu.2019.03.005  
22  
23  
24 17. Lin LY, Wang RH. Patient Education Competence Scale for Registered Nurses in  
25  
26 Taiwan: Scale development and psychometric validation. *Jpn J Nurs Sci*  
27  
28 2017;14(2):117-25. doi: 10.1111/jjns.12141  
29  
30  
31 18. Hwang HL, Kuo ML, Tu CT. Health education and competency scale:  
32  
33 Development and testing. *J Clin Nurs* 2018;27(3-4):e658-e67. doi:  
34  
35 10.1111/jocn.14116  
36  
37  
38 19. Pueyo-Garrigues M, Pardavila-Belio MI, Whitehead D, et al. Nurses' knowledge,  
39  
40 skills and personal attributes for competent health education practice: An  
41  
42 instrument development and psychometric validation study. *J Adv Nurs*  
43  
44 2021;77(2):715-28. doi: 10.1111/jan.14632  
45  
46  
47 20. Mi Y, Wu D, Wei ZZ, et al. Research progress on evaluation tool for health  
48  
49 education competency of nursing staff. *Chinese Nursing Research*  
50  
51 2020;34(11):1983-7. doi: 10.12102/j.issn.1009-6493.2020.11.023  
52  
53  
54 21. Prinsen CA, Mokkink LB, Bouter LM, et al. COSMIN guideline for systematic  
55  
56 reviews of patient-reported outcome measures. *Qual Life Res* 2018;27:1147-57.  
57  
58 doi: 10.1007/s11136-018-1798-3  
59  
60

- 1  
2  
3 1 22. Eskolin SE, Inkeroinen S, Leino-Kilpi H, et al. Instruments for measuring  
4  
5 2 empowering patient education competence of nurses: Systematic review. *J Adv*  
6  
7 3 *Nurs* 2023;79(7):2414-28. doi: 10.1111/jan.15597  
8  
9  
10 4 23. Mokkink LB, Prinsen C, Patrick DL, et al. COSMIN methodology for systematic  
11  
12 5 reviews of patient-reported outcome measures (PROMs). User manual.  
13  
14 6 2018;78(1):6-63. Available from: [https://www.cosmin.nl/wp-](https://www.cosmin.nl/wp-content/uploads/COSMIN-syst-review-for-PROMs-manual_version-1_feb-2018-1.pdf)  
15  
16 7 [content/uploads/COSMIN-syst-review-for-PROMs-manual\\_version-1\\_feb-2018-](https://www.cosmin.nl/wp-content/uploads/COSMIN-syst-review-for-PROMs-manual_version-1_feb-2018-1.pdf)  
17  
18 8 [1.pdf](https://www.cosmin.nl/wp-content/uploads/COSMIN-syst-review-for-PROMs-manual_version-1_feb-2018-1.pdf) accessed September 11 2023.  
19  
20  
21 9 24. Page MJ, Moher D, Bossuyt PM, et al. PRISMA 2020 explanation and  
22  
23 10 elaboration: updated guidance and exemplars for reporting systematic reviews.  
24  
25 11 *BMJ* 2021;372. doi: 10.1136/bmj.n160  
26  
27  
28 12 25. Mackintosh A, Comabella C, Hadi M, et al. PROM group construct & instrument  
29  
30 13 type filters. *Department of Public Health, University of Oxford, Oxford*. 2010.  
31  
32 14 Available from: [https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-](https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-2010.pdf)  
33  
34 15 [2010.pdf](https://cosmin.nl/wp-content/uploads/prom-search-filter-oxford-2010.pdf) accessed September 11 2023.  
35  
36  
37 16 26. Terwee CB, Jansma EP, Riphagen II, et al. Development of a methodological  
38  
39 17 PubMed search filter for finding studies on measurement properties of  
40  
41 18 measurement instruments. *Qual Life Res* 2009;18:1115-23. doi: 10.1007/s11136-  
42  
43 19 009-9528-5  
44  
45  
46 20 27. Babineau J. Product review: Covidence (systematic review software). *Journal of*  
47  
48 21 *the Canadian Health Libraries Association/Journal de l'Association des*  
49  
50 22 *bibliothèques de la santé du Canada* 2014;35(2):68-71.  
51  
52  
53 23 28. Mokkink LB, De Vet HC, Prinsen CA, et al. COSMIN risk of bias checklist for  
54  
55 24 systematic reviews of patient-reported outcome measures. *Qual Life Res*  
56  
57 25 2018;27:1171-9. doi: 10.1007/s11136-017-1765-4  
58  
59  
60

- 1  
2  
3 1 29. Terwee CB, Prinsen C, Chiarotto A, et al. COSMIN methodology for assessing  
4  
5  
6 2 the content validity of PROMs–user manual. *Amsterdam: VU University Medical*  
7  
8  
9 3 *Center*. 2018. Available from: <https://cosmin.nl/wp-content/uploads/COSMIN->  
10  
11 4 [methodology-for-content-validity-user-manual-v1.pdf](https://cosmin.nl/wp-content/uploads/COSMIN-methodology-for-content-validity-user-manual-v1.pdf) accessed September 11  
12  
13 5 2023.  
14  
15  
16 6 30. Terwee CB, Prinsen CA, Chiarotto A, et al. COSMIN methodology for  
17  
18 7 evaluating the content validity of patient-reported outcome measures: a Delphi  
19  
20 8 study. *Qual Life Res* 2018;27:1159-70. doi: 10.1007/s11136-018-1829-0  
21  
22  
23  
24  
25  
26  
27  
28  
29  
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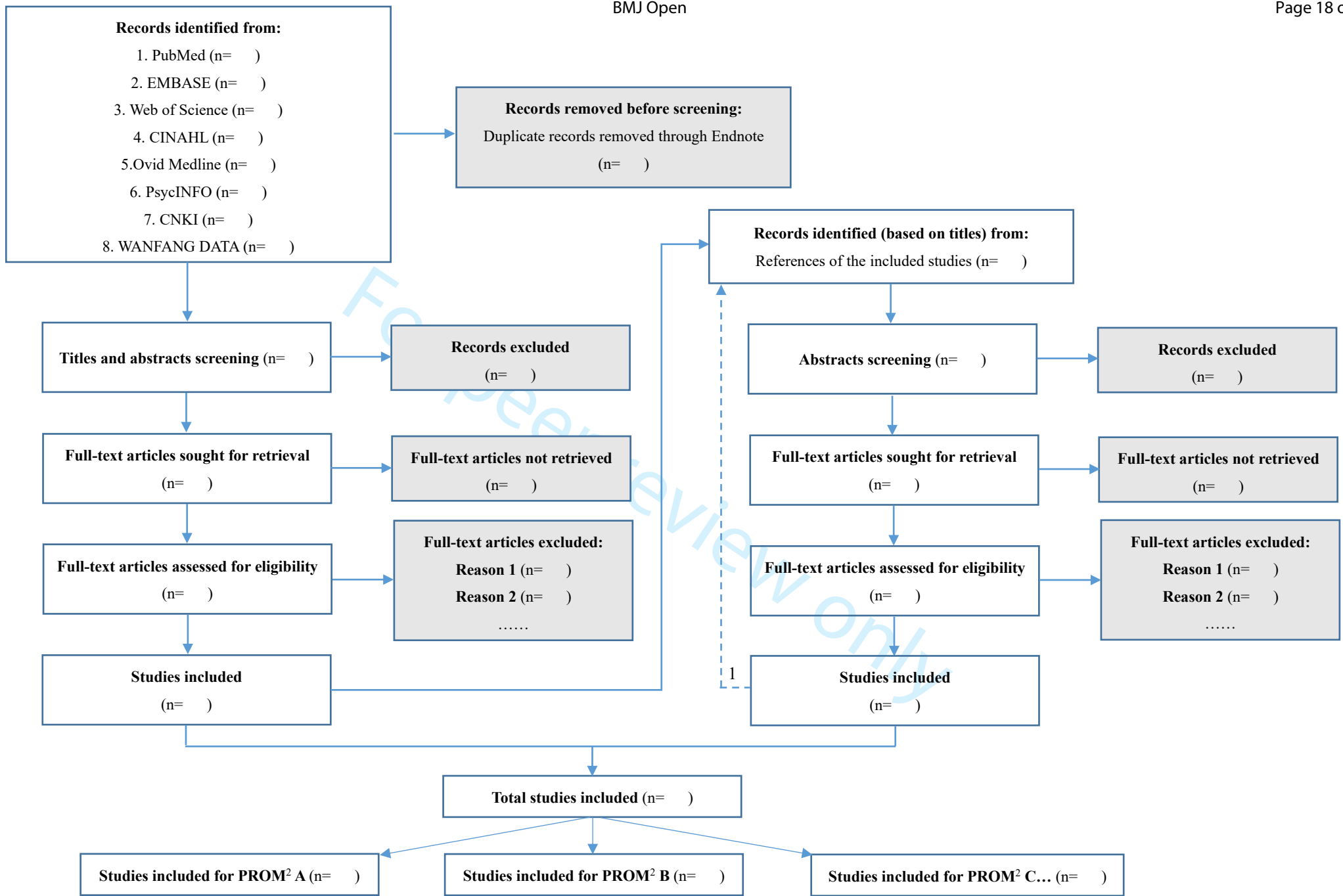


Figure 1. Flowchart of literature selection process

Note: 1. References of all included studies will be manually screened until no eligible studies can be identified.  
 2. PROM: patient-reported outcome measure.

Table S1. Reasons for inconsistencies

Revised content	Reason
1. Review title	Taking into consideration the inclusive scope of the article, encompassing both nursing staff and nursing students, a deliberate revision has been undertaken in the title adjustment, transitioning from the initial term “nursing staff” to the more comprehensive descriptor “nursing personnel”.
2. Funding	In the PROSPERO registration, the Funding sources/sponsors were initially documented as “None.” However, it is important to note that during the course of the study, we secured pertinent funding support. Consequently, the Funding section in the protocol was subsequently revised to accurately reflect this development.

Table S2. Search strategy for PubMed

1	#1	nurs*
2	#2	((((((((((Health Education[Mesh] OR Patient Education as Topic[Mesh]) OR (health education*[tiab])) OR (education, health[tiab])) OR (patient education*[tiab])) OR (education program*[tiab])) OR (educational program*[tiab])) OR (education, patient*[tiab])) OR (education of patient*[tiab])) OR (nursing education*[tiab])) OR (hospital education*[tiab])) OR (educational activit*[tiab])) OR ((educat*[tiab]) AND (individual patient*[tiab]))
3	#3	((((((((((professional competence[MeSH]) OR (professional competence[tiab])) OR (competence, professional[tiab])) OR (generalization of expertise[tiab])) OR (expertise generalization[tiab])) OR (technical expertise[tiab])) OR (expertise, technical[tiab])) OR (competenc*[tiab] OR capabilit*[tiab] OR capacit*[tiab] OR abilit*[tiab])) OR ((skill*[tiab] OR belief[tiab] OR attitude[tiab]) AND (knowledge[tiab]))
4	#4	(report[tiab] OR reported[tiab] OR reporting[tiab] OR rated[tiab] OR rating[tiab] OR ratings[tiab] OR based[tiab] OR assessed[tiab] OR assessment[tiab] OR assessments[tiab] OR disability[tiab] OR function[tiab] OR functional[tiab] OR functions[tiab] OR subjective[tiab] OR utility[tiab] OR utilities[tiab] OR wellbeing[tiab] OR well being[tiab]) AND (index[tiab] OR indices[tiab] OR instrument[tiab] OR instruments[tiab] OR measure[tiab] OR measures[tiab] OR questionnaire[tiab] OR questionnaires[tiab] OR profile[tiab] OR profiles[tiab] OR scale[tiab] OR scales[tiab] OR score[tiab] OR scores[tiab] OR status[tiab] OR survey[tiab] OR surveys[tiab])

5	#5	<p>(instrumentation[sh] OR methods[sh] OR "Validation Studies"[pt] OR "Comparative Study"[pt] OR "psychometrics"[MeSH] OR psychometr*[tiab] OR clinimetr*[tw] OR clinometr*[tw] OR "outcome assessment (health care)"[MeSH] OR "outcome assessment"[tiab] OR "outcome measure*" [tw] OR "observer variation"[MeSH] OR "observer variation"[tiab] OR "Health Status Indicators"[Mesh] OR "reproducibility of results"[MeSH] OR reproducib*[tiab] OR "discriminant analysis"[MeSH] OR reliab*[tiab] OR unreliab*[tiab] OR valid*[tiab] OR "coefficient of variation"[tiab] OR coefficient[tiab] OR homogeneity[tiab] OR homogeneous[tiab] OR "internal consistency"[tiab] OR (cronbach*[tiab] AND (alpha[tiab] OR alphas[tiab])) OR (item[tiab] AND (correlation*[tiab] OR selection*[tiab] OR reduction*[tiab])) OR agreement[tw] OR precision[tw] OR imprecision[tw] OR "precise values"[tw] OR test-retest[tiab] OR (test[tiab] AND retest[tiab]) OR (reliab*[tiab] AND (test[tiab] OR retest[tiab])) OR stability[tiab] OR interrater[tiab] OR inter-rater[tiab] OR intrarater[tiab] OR intra-rater[tiab] OR intertester[tiab] OR inter-tester[tiab] OR intratester[tiab] OR intra-tester[tiab] OR interobserver[tiab] OR inter-observer[tiab] OR intraobserver[tiab] OR intra-observer[tiab] OR intertechnician[tiab] OR inter-technician[tiab] OR intratechnician[tiab] OR intra-technician[tiab] OR interexaminer[tiab] OR inter-examiner[tiab] OR intraexaminer[tiab] OR intra-examiner[tiab] OR interassay[tiab] OR inter-assay[tiab] OR intraassay[tiab] OR intra-assay[tiab] OR interindividual[tiab] OR inter-individual[tiab] OR intraindividual[tiab] OR intra-individual[tiab] OR interparticipant[tiab] OR inter-participant[tiab] OR intraparticipant[tiab] OR intra-participant[tiab] OR kappa[tiab] OR kappa's[tiab] OR kappas[tiab] OR repeatab*[tw] OR ((replicab*[tw] OR repeated[tw]) AND (measure[tw] OR measures[tw] OR findings[tw] OR result[tw] OR results[tw] OR test[tw] OR tests[tw])) OR generaliza*[tiab] OR generalisa*[tiab] OR concordance[tiab] OR (intraclass[tiab] AND correlation*[tiab]) OR discriminative[tiab] OR "known group"[tiab] OR "factor analysis"[tiab] OR "factor analyses"[tiab] OR "factor structure"[tiab] OR "factor structures"[tiab] OR dimension*[tiab] OR subscale*[tiab] OR (multitrait[tiab] AND scaling[tiab] AND (analysis[tiab] OR analyses[tiab])) OR "item discriminant"[tiab] OR "interscale correlation*" [tiab] OR error[tiab] OR errors[tiab] OR "individual variability"[tiab] OR "interval variability"[tiab] OR "rate variability"[tiab] OR (variability[tiab] AND (analysis[tiab] OR values[tiab])) OR (uncertainty[tiab] AND (measurement[tiab] OR measuring[tiab])) OR "standard error of measurement"[tiab] OR sensitiv*[tiab] OR responsive*[tiab] OR (limit[tiab] AND detection[tiab]) OR "minimal detectable concentration"[tiab] OR interpretab*[tiab] OR ((minimal[tiab] OR minimally[tiab] OR clinical[tiab] OR clinically[tiab]) AND (important[tiab] OR significant[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR (small*[tiab] AND (real[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR "meaningful change"[tiab] OR "ceiling effect"[tiab] OR "floor effect"[tiab] OR "Item response model"[tiab] OR IRT[tiab] OR Rasch[tiab] OR "Differential item</p>
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		functioning"[tiab] OR DIF[tiab] OR "computer adaptive testing"[tiab] OR "item bank"[tiab] OR "cross-cultural equivalence"[tiab])
6	#6	("addresses"[Publication Type] OR "biography"[Publication Type] OR "case reports"[Publication Type] OR "comment"[Publication Type] OR "directory"[Publication Type] OR "editorial"[Publication Type] OR "festschrift"[Publication Type] OR "interview"[Publication Type] OR "lectures"[Publication Type] OR "legal cases"[Publication Type] OR "legislation"[Publication Type] OR "letter"[Publication Type] OR "news"[Publication Type] OR "newspaper article"[Publication Type] OR "patient education handout"[Publication Type] OR "popular works"[Publication Type] OR "congresses"[Publication Type] OR "consensus development conference"[Publication Type] OR "consensus development conference, nih"[Publication Type] OR "practice guideline"[Publication Type]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms])
7	#7	#1 AND #2 AND #3 AND #4 AND #5 NOT #6

Note: "\*" to include all derivatives of that word or concept.

Table S3. Search strategy for Chinese databases

1	#1	TKA = 护理 OR TKA = 护士 OR TKA = 护生
2	#2	TKA = 健康教育能力 OR TKA = 患者教育能力 OR TKA = 健康教育胜任力 OR TKA = 患者教育胜任力
3	#3	SU = 评估 OR SU = 测量 OR SU = 评价 OR SU = 收集 OR SU = 调查 OR SU = 工具 OR SU = 问卷 OR SU = 量表 OR SU = 仪器 OR SU = 研究
4	#4	TKA = 信度 OR TKA = 效度 OR TKA = 反应度 OR TKA = 内部一致性 OR TKA = 稳定性 OR TKA = 相关系数 OR TKA = 克朗巴赫系数 OR TKA = 探索性因子分析 OR TKA = 验证性因子分析 OR TKA = 探索性因素分析 OR TKA = 验证性因素分析 OR TKA = 检验 OR TKA = 结果
5	#5	#1 AND #2 AND #3 AND #4

Note: TKA = title/abstract; SU = title/abstract/keywords.

Table S4. Characteristics of the included instruments

<b>Instrument name</b>	<b>Developer(s)/ year developed</b>	<b>Construct (s)</b>	<b>Target population</b>	<b>Mode of administration</b>	<b>Recall period</b>	<b>(Sub)scale (s) (number of items)</b>	<b>Response options</b>	<b>Range of scores/scoring</b>	<b>Original language</b>	<b>Available translations</b>

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Table S5. Characteristics of the included study populations

Instrument	Ref	Population			Instrument administration			Response rate
		N	Age Mean (SD, range) yr	Gender % female	Setting	Country	Language	
A	1							
	2							
	3							
B	1							

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Table S6. Rating the measurement properties of the instruments

Instrument	Study 1			Study 2			Study 3			OVERALL					
	RATING	RATING	RATING	RATING	RATING	RATING	RATING	RATING	RATING	OVERALL RATING	OVERALL RATING	OVERALL RATING	QUALITY OF EVIDENCE	QUALITY OF EVIDENCE	QUALITY OF EVIDENCE
	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	+/-/?	High, moderate, low, very low	High, moderate, low, very low	High, moderate, low, very low
	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus	rater 1	rater 2	consensus
Structural validity															
internal consistency															
Cross-cultural validity															
Measurement invariance															
Reliability															
Measurement error															
Criterion validity															
Construct validity															
Responsiveness															

Note: "+" = sufficient; "-" = insufficient; "?" = indeterminate.



Table S6-1. Rating of the content validity of instruments

Instrument (Reference – study type/Rating of reviewers)	Content Validity													
	Relevance <sup>1</sup>					Comprehensiveness <sup>1</sup>		Comprehensibility <sup>1</sup>					CONTENT VALIDITY RATING <sup>2</sup>	
	1. Are the included items relevant for the construct of interest?	2. Are the included items relevant for the target population of interest?	3. Are the included items relevant for the context of use of interest?	4. Are the response options appropriate?	5. Is the recall period appropriate?	RELEVANCE RATING <sup>2</sup>	6. Are all key concepts included?	COMPREHENSIVENESS RATING <sup>2</sup>	7. Are the PROM instructions understood by the population of interest as intended?	8. Are the PROM items and response options understood by the population of interest as intended?	9. Are the PROM items appropriately worded?	10. Do the response options match the question?	COMPREHENSIBILITY RATING <sup>2</sup>	
A (Ref 1- instrument development study)														
A (Ref 2 - Content validity study)														
A (Ref 3 - Content validity study)														
Rating of reviewers														
B (Ref 1- instrument development study)														
B (Ref 2 - Content validity study)														
Rating of reviewers														



Table S7. Information on interpretability of instruments

Instrument (ref)		Percentage of missing items and percentage of missing total scores	Floor and ceiling effects	Scores and change scores available for relevant (sub)groups	Minimal important change (MIC) or minimal important difference (MID)	Information on response shift
Instrument A (ref 1)						
Instrument A (ref 2)						
Instrument A (ref 3)						
Instrument B (ref 1)						
.....						

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Table S8. Information on feasibility of instruments

<b>Feasibility aspects</b>	<b>Instrument A</b>	<b>Instrument B</b>	<b>Instrument C</b>	<b>Instrument D</b>
Patient's comprehensibility				
Clinician's comprehensibility				
Type and ease of administration				
Length of the instrument				
Completion time				
Patient's required mental and physical ability level				
Ease of standardization				
Ease of score calculation				
Copyright				
Cost of an instrument				
Required equipment				
Availability in different settings				
Regulatory agency's requirement for approval				

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Table S9. Quality<sup>1</sup> of studies on measurement properties

Instrument	Content validity <sup>2</sup>					Structural validity	Internal consistency	Cross-cultural validity	Reliability	Measurement error	Criterion validity	Convergent validity
	Asking patients			Asking experts								
	Relevance	Comprehensiveness	Comprehensibility	Relevance	Comprehensiveness							
A												
B												
.....												

Note: 1. Quality: V = very good, A = adequate, D = doubtful, I = inadequate.

2. Given that the criteria and rating systems for evaluating the content validity of instruments are different from those for other measurement properties, the quality results of content validity are not included in this table but separately shown in following Table S8-1.

Table S9-1. Quality<sup>1</sup> of the instrument development

Instrument	PROM design							Cognitive interview (CI) study <sup>3</sup>				TOTAL PROM DEVELOPMENT
	General design requirements					Concept elicitation <sup>2</sup>	Total PROM design	General design requirements	Comprehensibility	Comprehensiveness	Total CI study	
	Clear construct	Clear origin of construct	Clear target population for which the PROM was developed	Clear context of use	PROM developed in sample representing the target population			CI study performed in sample representing the target population				
A												
B												
.....												

Note: 1. Quality: V = very good, A = adequate, D = doubtful, I = inadequate.

2. The concept elicitation will not be further rated if the instrument(s) was not developed in the sample representing the target population.

3. Empty cells indicate that a CI study (or part of it) was not performed.

Table S10. Quality of the evidence for measurement properties of the instruments (Summary of findings)

Instrument	Content validity		Structural validity		Internal consistency		Cross-cultural validity		Reliability		Measurement error		Criterion validity		Hypotheses testing		Responsiveness	
	Overall Rating <sup>1</sup>	Quality of Evidence <sup>3</sup>	Overall Rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>	Overall rating <sup>2</sup>	Quality of evidence <sup>3</sup>
Instrument A																		
Instrument B																		
Instrument C																		
.....																		

Note:1. Overall ratings for the content validity (relevance, comprehensiveness, comprehensibility) can only be + / - /±: ‘ + ’= sufficient, ‘ - ’= insufficient, ‘±’ = inconsistent.

2. Overall ratings for other measurement properties can be + / - /± / ? : ‘ + ’= sufficient, ‘ - ’= insufficient, ‘±’ = inconsistent, ‘?’ =indeterminate.

3. Ratings for quality of evidence: High, Moderate, Low, Very low.

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**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol\***

Section and topic	Item No	Checklist item	Pg.
<b>ADMINISTRATIVE INFORMATION</b>			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Pg. 1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	Pg. 2 and Pg. 6
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Pg. 1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Pg. 11-12
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Pg. 12
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
<b>INTRODUCTION</b>			
Rationale	6	Describe the rationale for the review in the context of what is already known	Pg. 3-6
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Pg. 6
<b>METHODS</b>			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Pg. 7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Pg. 7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	Supplemental file
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Pg. 8



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2			
3	Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)
4			Pg. 8
5	Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators
6			Pg. 8-9
7	Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications
8			Supplemental file
9	Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale
10			Pg. 8-9
11	Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis
12			Supplemental file
13	Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised
14			N/A
15		15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$ , Kendall's $\tau$ )
16			N/A
17		15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)
18			N/A
19		15d	If quantitative synthesis is not appropriate, describe the type of summary planned
20			Pg. 10
21	Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)
22			N/A
23	Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)
24			Pg. 9-10

**\* It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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