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Developing a professional competency framework for general practitioners in tertiary hospitals in China: A modified Delphi study

Journal:	BMJ Open
Manuscript ID	bmjopen-2023-082736
Article Type:	Original research
Date Submitted by the Author:	02-Dec-2023
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Keywords:	Public Hospitals < Hospitals, Public, Surveys and Questionnaires, Clinical Competence, GENERAL MEDICINE (see Internal Medicine), China





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Developing a professional competency framework for general practitioners in tertiary hospitals in China: A modified Delphi study

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Abstract

Objective. At present, the competency of GPs in tertiary hospitals has not been reported and there is no suitable competency evaluation tool. This study was conducted to develop a professional competency framework for GPs in tertiary hospitals.

Design. A modified Delphi method was adopted in the study.

Participants. Considering the expert authority, a wide range of sources, expert qualification and willingness, 20 eligible experts were invited and 19 experts agreed to participate in this study.

Results. Nineteen experts (the mean age was 51.84 [6.78] years and 84.2% were women) participated in both two rounds of Delphi survey. From literature review, 4 primary indicators, 14 secondary indicators, and 48 tertiary indicators were identified. After two rounds of Delphi survey, a consensus was reached on 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators. The expert authority coefficient of three levels of indicators were 0.85-0.89, 0.86-0.89, 0.86-0.91, respectively. The coordination coefficient of importance and operability score of primary indicators, secondary indicators, and tertiary indicators in both two rounds were 0-1 (P<0.001).

Conclusion. The professional competency framework for GPs in tertiary hospitals in China was successfully constructed in this study with good scientific soundness and rationality. It is expected to be used in medical education, general practice research, quality improvement, and more broadly within the health care system to reflect the competency of GPs in tertiary hospital.

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Key words. China, competency, Delphi method, general practitioner, tertiary hospital

STRENGTHS AND LIMITATIONS OF THIS STUDY

 \Rightarrow This Delphi process has engaged experts with a wide range of areas, including management personnel in general practice departments in tertiary hospitals, GPs in tertiary hospitals, government administrators, or scientific researchers in the field of general practice.

 \Rightarrow Satisfactory result about experts' positive coefficient, authority coefficient, and coordination coefficient were shown in this study reflecting the scientific soundness and rationality of the Delphi method.

 \Rightarrow A broad recruitment strategy was employed, but we may have missed nurses in general practice department and patients.

⇒ Experts in this study were mostly from Beijing.

Introduction

In recent years, hospital-centric health delivery system was prevailing in China, in which patients preferred to get medical services in public tertiary hospitals rather than primary health care (PHC) institutions, leading to a perception of health services as "too difficult to access and too expensive".¹ In order to improve access to health care, the Chinese government issued guidelines for building a so-called tiered health-care delivery system whereby each level of health-care facility (tertiary, secondary, and primary) would deliver care according to their designated functions in 2015.² Patients can be treated at the primary or community health centre level by general practitioners (GPs) for common and minor illnesses and be referred to hospitals (secondary or tertiary) for more complex and severe disorders. Care across the levels was to be integrated and coordinated with bidirectional referral mechanisms through establishing medical alliance or integrated systems.³

However, in practice, a patient in China may visit a health care provider from any tier without referral, and previous studies have consistently shown that health-care services predominantly took place in tertiary hospital with a potential reason that service quality in tertiary hospitals was higher compared with primary care and secondary hospitals.^{4,5} In addition, evidence suggests shortfalls with respect to hypertension and diabetes, which are the most common chronic conditions encountered in PHC settings.⁶ China has substantially increased financial investment and introduced favourable policies for strengthening its primary health care system with core responsibilities in preventing and managing chronic diseases. However, widespread gaps in the quality of primary health care still exist. System challenges include: the suboptimal education and training of primary health-care practitioners, a fee-for-service payment system that incentivises testing and treatments over prevention, fragmentation of clinical care, and insufficient continuity of care throughout the entire health-care system. ⁶

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To increase general medical service, strengthen the training of GPs, facilitate an effective and efficient healthcare system, and improve the quality of health management, the Chinese government stipulate all tertiary hospitals to establish general

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practice departments till 2019.⁷ The basic functions of the general practice departments of tertiary hospitals in China included: (1) providing comprehensive and coordinated medical services, including diagnosis and treatment, chronic disease management, and health education. (2) carrying out standardized residency training for GPs, including formulating training plans, outpatient and inpatient teaching, evaluation, etc. (3) carrying out scientific research in the fields of innovation of primary health service model, clinical research about general practice, quality improvement, etc. (4) providing prevention-oriented health services, including screening, primary prevention, health education, and self-management.⁸ At present, most GPs in tertiary hospitals were doctors from other departments after the on-job training (1-year training for doctors who want to register as GP). New GPs recruited to the general practice departments in tertiary hospitals should have a PhD degree and have finished the standardized residency training in general practice. According to statistics in 2021, there were 54,115 GPs in tertiary hospitals, (accounting for 12.4% of the total GPs in China).⁹

Professional competency in medicine was defined as "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served" by Epstein and Hundert in JAMA.¹⁰ In some western countries, practical competency models for GPs, such as the Family Medicine Milestone Project in the US,¹¹ Workplace Based assessment and Annual Review of Competence Progression guidance in the UK,¹² the CanMEDS-FM 2017 in Canada,¹³ and Competency profile of the Australian general practitioner at the point of fellowship in Australia,¹⁴ have widely used in competency assessment of GPs in primary care. In China, there were studies concentrated on development of competency models for GPs in rural areas¹⁵ and GPs after standardized residency training.¹⁶

Generally, general practice provides "person-centred, continuing, comprehensive and coordinated whole person healthcare to individuals and families in their communities with common and frequently-occurring diseases".¹⁷ Typically, the epidemiology of multimorbidity among the inpatients admitted to the general practice departments of tertiary hospitals are complex. As reported in previous study, the

prevalence of multimorbidity among inpatients in the general practice department of tertiary hospitals in China is extremely high, reaching 93.1%.⁷ In addition, considering the functions of the general practice departments of tertiary hospitals, the professional competency of GPs in tertiary hospitals may be different from GPs in primary care. The aim of this study was to develop a professional competency framework for GPs in tertiary hospitals, and provide reference for further evaluation of GPs' competency in the future.

Methods

Design

A modified Delphi method was adopted in the study, which was the most widely used method for selecting quality indicators in healthcare.^{18,19} There is no restriction on the number of rounds that can be conducted,²⁰ but two or three rounds are most common.²¹⁻²³ The process ends when an agreement has been reached on the discussed topics. This study involved two rounds of questionnaires to an expert panel via e-mail from August to October 2022. The Delphi process was carried out in accordance with previous studies^{16,22,23} and research guideline for the Delphi survey technique,²⁴ which included two stages: (1) generating an initial set of potential competencies to be considered for inclusion in the competency model for GPs in tertiary hospitals from a systematic review; (2) conducting a 2-round modified Delphi survey to prioritize and gain consensus on the most essential competencies for GPs in tertiary hospitals.

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Figure 1 is here

Participants

The basic criteria for the selection of experts in our study include: (i) expert authority, which means the academic background related to general practice in tertiary hospitals; (ii) a wide range of sources, including management personnel in general practice departments in tertiary hospitals, GPs in tertiary hospitals, government administrators, or scientific researchers in the field of general practice; (iii) expert qualification, which refers to a senior professional title or a n associate senior grade title; and (iv) willingness to participate in this research. Finally, 20 eligible experts were invited and 19 experts agreed to participate in this study.

Questionnaire preparation

Four primary indicators (medical services, teaching, research, and prevention) were determined based on the basic functions of the general practice departments of tertiary hospitals in China.⁸ A preliminary list of secondary and tertiary indicators was constructed by literature review. Literature was searched in PubMed and three Chinese databases (China National Knowledge Infrastructure, Wanfang Data, VIP Chinese Periodical Services) with terms commonly used to describe GP (e.g., general practitioner, family physician, family doctor), tertiary hospital (e.g., tertiary hospital, general hospital, hospital), competency (e.g., competency, competence, ability).

Potential competencies were extracted and screened by 2 reviewers (YW and QMC) according to following criteria: (a) the indicators were applicable to measure the competency of GPs in tertiary hospitals; (b) the indicators were relevant to requirements of GPs' work in tertiary hospitals in China; (c) the indicators were relevant to development of GPs in tertiary hospitals. When there were doubts about whether an indicator should be retained, the research team would discuss together to make a decision. Based on this, a preliminary professional competency framework for GPs in tertiary hospitals in China 48 tertiary indicators.

All indicators in the preliminary professional competency framework for GPs in tertiary hospitals in China were formatted into Delphi questionnaire. Importance and feasibility of the competency indicators were rated on a 1-9 Likert scale (1 = not important/feasible; 9 = very important/feasible). In addition, the degree of experts' familiarity of indicators and the evidence for the experts to make a judgment were evaluated. Spaces were left for experts to make comments on these existing competency indicators or recommend new competency indicators which they considered should be included in.

Delphi survey

First round. The first round of Delphi survey was performed in 4 weeks in August 2022. The first-round questionnaire was sent to experts by e-mail, along with materials about research background, the aim of the study, basic demographic information

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collection form, and detailed instructions of scoring criteria for indicators. In the firstround questionnaire, experts were asked to rate the importance and feasibility of each competency indicator using the 1-9 Likert scale, give their comments on the existing indicators, and recommend new competency indicators which they considered should be included in.

After the first round of Delphi survey, data was collected and analyzed. The median and the distribution of scores (frequency count of answer choices), as well as comments were reported. The rating result of each indicator and comments were discussed after the round one feedback. Competency indicators achieving consensus level or being modified based on experts' comments were retained for the second round of Delphi survey. New indicators were added into second-round questionnaire based on the suggestion by more than two experts. Indicators were removed which did not achieved consensus level or were recommended to be removed by more than 2 experts.^{22,25}

Second round. The second round of Delphi survey was completed between September and October 2022, lasting 4 weeks. The competency indicators confirmed in the first round of Delphi survey were formulated into the second-round questionnaire, which was sent to the same experts with the first-round survey by e-mail, along with a graphbased report of the first round of Delphi survey results. Importance and feasibility of each competency indicator were rated using the same 1-9 Likert scale as in the first round. In this round of survey, participants were also given a chance to suggest additional competency indicators, argue for or against proposed competency indicators, and comment on competency indicators wording and comprehension. Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

Consensus. There was no definite consensus criteria for the Delphi study.²⁶ In this study a consensus was reached based on two selection criteria: median score greater than seven on a nine-point scale and at least 70% of panel ratings in the top tertile (7–9) for importance and feasibility.²⁷

Statistical analysis

The scientific soundness and rationality of the Delphi method were reflected by experts' positive coefficient, authority coefficient, and coordination coefficient in this study.²⁸ The degree of experts' activeness was reflected by the effective response rate to the

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consultation questionnaire and determines the credibility and scientific basis of the results. The authority coefficient of experts (Cr) was calculated on the basis of their judgement-making ability (Ca) and familiarity with the surveyed indicators (Cs); Cr was calculated by using the following formula: Cr = (Ca + Cs)/2.²⁹ Kendall's W concordance coefficient test was used to reflect the coordination coefficient though assessing the quality of expert consultation and measuring the difference in expert opinions on the importance, feasibility and sensitivity of each indicator. That is, the consistency of n experts' scoring results of K indicators at various levels, and the value is 0-1. Statistical significance of Kendall's W test results indicates consensus among experts.³⁰ The database was established and inputted by two researchers simultaneously using Epidata 3.0. If there was any difference or error, the third researcher would check and correct it. Descriptive analysis was used to describe the characteristics of participates

Epidata 3.0. If there was any difference or error, the third researcher would check and correct it. Descriptive analysis was used to describe the characteristics of participates and results. Means [with standard deviation (SD)] were used to report continuous variables, while frequencies (%) were used to report categorical variables. The median and the distribution of scores (frequency count of answer choices) were used to report the rating result of each indicator. The Data management and analysis were performed using Statistical Package for Social Science (SPSS), version 22.0.

Results

Panel characteristics in Delphi survey

All of the 19 experts participated in both two rounds of Delphi survey, with 16 female participants (84.2%) and 3 male participants (15.8%). The mean age of the experts was 51.84 years (standard deviation: 6.78 years). Among them, 15 experts were from Beijing, 2 experts were from Zhejiang Province, one from Guangdong Province, and one from Hainan Province. Directors of general practice departments in tertiary hospitals accounted for 63.2%, GPs in tertiary hospitals accounted for 15.8%, researchers in the field of general practice accounted for 15.8%, and there was one government administrator (5.3%). There were 94.7% experts had master or PhD degree and 100% experts were with senior grade title. The average length of general practice experience was 9.95 years, with 26.3% experts working for less than 5 years, 42.1%

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experts working for 5-10 years, and 31.6% experts working for over 10 years in this field. There were 73.7% experts had participated in the on-job training, 10.5% experts had participated in the standardized residency training, and 84.2% had participated in other training (faculty training of general practice) (Table 1).

Table 1 is here

The scientific soundness and rationality of the Delphi method

The experts' positive coefficient indicated by the effective response rate of participated experts were 100% in both rounds of Delphi survey. The expert authority coefficient of three levels of indicators were 0.85-0.89, 0.86-0.89, 0.86-0.91, respectively.

In the first round of Delphi survey, the coordination coefficient of importance score of primary indicators, secondary indicators, and tertiary indicators were 0.463 (x2=26.37, P<0.001), 0.445 (x2=109.84, P<0.001), and 0.402 (x2=358.73, P<0.001), respectively. The coordination coefficient of operability score of three levels of indicators were 0.349 (x2=19.89, P<0.001), 0.256 (x2=63.23, P<0.001), and 0.269 (x2=240.63, P<0.001), respectively. In the second round of Delphi survey, the coordination coefficient of importance score of three levels of indicators were 0.489 (x2=27.89, P<0.001), 0.387 (x2=80.88, P<0.001), 0.285 (x2=287.07, P<0.001), respectively. The coordination coefficient of operability score of three levels of indicators were 0.467 (x2=26.63, P<0.001), 0.337 (x2=70.43, P<0.001), 0.243 (x2=245.04, P<0.001), respectively (Table 2).

Table 2 is here

First round

In the first round, all primary indicators achieved consensus except for indicator "3. Research", which did not achieve 70.0% agreement in terms of feasibility (63.2% of experts rating in the top tertile with 7-9). Considering that the importance and feasibility of the secondary and tertiary indicators within the scope of indicator "3. Research" achieved consensus, it was retained to the second round of expert consultation. All secondary indicators achieved consensus except for indicator "3.3 Data processing", which did not achieve 70.0% agreement in both of importance (63.2% agreement) and

feasibility (63.2% agreement). All 48 tertiary competency indicators achieved consensus in round one. The median score of importance and feasibility ranged from 7.00 to 9.00 and 7.00 to 9.00, respectively. The percentage of panel ratings in the top tertile (7–9) for importance and feasibility ranged from 73.7% to 100% (Table 3).

Table 3 is here

Adjustment of competency indicators after the first round of Delphi survey was shown in table 4. Description of 7 secondary indicators and 11 tertiary indicators were modified. Secondary indicator "2.3 Joint teaching with primary care" was merged into secondary indicator "2.2 Practical teaching ". Tertiary indicator "3.3.1 Data collation" and tertiary indicator "3.3.2 Data analysis" are merged as "3.3.1 Statistical analysis of data". One secondary indicator "3.3 Data processing" was deleted due to not achieve consensus level. There were 7 new tertiary indicators being suggested to added by more than two experts and hence included in the second round.

Table 4 is here

Second round

At this step, 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators were evaluated, including retained, modified, and new competency indicators. In the second round, the median values of importance and feasibility scores for three levels of indicators were 7.00-9.00 and 7.00-9.00, respectively. The percentages of panel ratings in the top tertile (7–9) about importance and feasibility were 89.5%-100% and 84.2%-100% for primary indicators, $84.2\% \sim 100\%$ and $84.2\% \sim 100\%$ for secondary indicators, $89.5\% \sim 100\%$ and $84.2\% \sim 100\%$ for tertiary indicators (Table 3). As a result, all competency indicators achieved consensus in terms of importance and feasibility in this round.

After two rounds of Delphi survey, the professional competency framework for GPs in tertiary hospitals in China was constructed, which included: 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators.

Discussion

Main finding

This study presents the results of the development of a professional competency

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 framework for GPs in tertiary hospitals in China, in which 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators reached consensus after two rounds of the Delphi survey.

Reliability analysis

The quality of panel experts and their opinions on given topics is seen as key factor of the Delphi technique.³¹ In this study, good representation of experts was reflected in experts' academic background in general practice, the presence of different professionals (including management personnel in general practice department in tertiary hospitals, GPs in tertiary hospitals, government administrators, and professors in medical universities), and expert qualification (with a senior professional title or a n associate senior grade title). Experts in this study had a deep understanding of the competencies that GPs in tertiary hospitals should be capable of. In addition, the reliability of Delphi method results was mainly judged according to degree of experts' activeness, authority coefficient, and coordination coefficient of experts.²⁸ The 100% effective return rate of the questionnaire in both rounds of Delphi survey in this study indicated the high enthusiasm of experts. Previous data showed that an effective response rate of 50% was the minimum acceptable value for the Delphi method, 60% was considered moderate, and over 70% met a very good standard.³² The expert authority coefficient of three levels of indicators in professional competency framework for GPs in tertiary hospitals in China were >0.70, indicating that the experts involved in this study had high authority in this field and the results were trustworthy.³³ On the basis of Kendall's coefficient of concordance, the p-value of the primary, secondary, and tertiary indicators in both two rounds of survey were calculated as <0.001. Therefore, the coordination degree of the expert questionnaire was optimal. Comparison to previous competency frameworks

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The indicators of professional competency framework for GPs in tertiary hospitals in China were developed focusing on the current functions of the general practice departments of tertiary hospitals and were applicable to the whole country.⁸ In 2018, Chinese government began requiring all tertiary hospitals to establish general practice departments and designating them as engines for increasing general medical service

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capacity and quality. The patients admitted to the general practice departments of tertiary hospitals in China were mostly suffering from chronic diseases and multimorbidity.⁷ Patients with multimorbidity face reduced quality of life, prolonged hospital stay, increased number of readmissions, increased emergency visit rate, high incidence of multiple medications, adverse drug events, etc.³⁴⁻³⁷ Therefore, the medical service ability was important and primary for GPs in tertiary hospitals, including clinical knowledge and skills, diagnosis and treatment, chronic disease management, and communication. As described in previous competency model in America, the practice of general practice demands a broad and deep fund of knowledge to proficiently care for a diverse patient population with undifferentiated health care needs.¹¹ Disease diagnosis and treatment and chronic disease management are the basic tasks of GPs as in WONCA tree.³⁸ Besides, effective communication was crucial to doctor-patient relationship.³⁹ For general practice, communication and empathy are essential in patient-centered care,⁴⁰ which was proved by CanMEDS-FM 2017 in Canada,¹³ the family medicine milestone project in America,¹¹ and competency profile of the Australian general practitioner at the point of fellowship in Australia.¹⁴

Compared with foreign competency models for GPs,^{11-14,38} it is notable that there are two aspects (teaching and research) special in the professional competency framework for GPs in tertiary hospitals in China. As clinical residential training bases, general practice department in tertiary hospitals need to undertake tasks about teaching and training, including taking the lead in formulating and implementing training plans, carrying out outpatient and ward teaching, cooperating with primary care institutions in teaching.⁸ Therefore, teaching ability was also important for GPs in tertiary hospitals in China. On the part of joint training with primary care, joint theoretical lectures, case discussion, and other indicators consistent with the national policy orientation are considered into the professional competency framework for GPs in tertiary hospitals in China. Additionally, scientific research ability of GPs was related to promotion of professional title in tertiary hospital in China. In this condition, abilities about scientific research design, practice, and transformation of scientific research results were emphasized in the competency framework for GPs in tertiary hospitals.

Another important indicator of professional competency framework for GPs in tertiary hospitals in China was prevention. The provision of effective preventive care aims to reduce preventable morbidity and mortality, enhance quality of life and decrease an individual's need generally for medical services.⁴¹ Since the mid-1990s professional bodies have argued that prevention should be a constituent element of normal professional practice of GPs and nurses and that prevention and health promotion should be an integral part of general practice.⁴² GPs can positively influence their patient's lifestyle choices, and encourage and equip them to take a greater interest in, and greater responsibility for, their own health.⁴³ Same as the family medicine milestone project in America¹¹ and competency profile of the Australian general practitioner at the point of fellowshi,¹⁴ screening and health risks management were considered as important parts of competency evaluation of GPs in tertiary hospitals in China.

Compared with previous competency models of GPs in China, there are some similarities and differences. GPs' abilities about medical service and doctor-patient communication were emphasized in either of the professional competency framework for GPs in tertiary hospitals or previous competency models for GPs.^{15,16} Although teaching and research were also indicated in the competency model for GPs after standardized residency training,¹⁶ the evaluation standards will be higher and more stringent for GPs in tertiary hospitals. In this research, the competency framework included the evaluation indicators of GPs' ability of teaching the residency trainees and joint teaching with primary care. Besides, it is notable that there are two aspects special in PHC in China: basic public health service and "family doctor contract" services. An independent domain of "Basic public health service" and "teamwork" were identified in previous competency models for GPs.^{15,16} Another difference was the indicator "prevention", which was firstly included in the competency model for GPs in China in this study as an independent and primary indicator.

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Strengths and limitations

In most health service systems, GPs are classified as primary health care providers. However, in the special health care context of China, GPs in tertiary hospitals play a

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multiple role of medical service provider, GP trainer, researcher, and preventive service provider.⁸ This is the first study to explore the competency content of GPs in tertiary hospitals, which is helpful to reflect the competence of GPs and improve the quality of general practice service in China. Additionally, a modified Delphi method was adopted, through which, diverging expert assessments and opinions become transparent and ultimately resolved and consented upon.⁴⁴ In this study, satisfactory result about experts' positive coefficient, authority coefficient, and coordination coefficient were shown to reflect the scientific soundness and rationality of the Delphi method.

A potential limitation of this study is the narrow geographical diversity of respondents. Experts in this study were mostly from Beijing and the proportion of experts in other provinces was low. They may not adequately represent the full spectrum of views held by individuals in different regions across China. Though the steering group included a broad range of representatives, some stakeholders may have been underrepresented. For example, nurses in general practice department and patients were not represented (as nurses are collaborators with GPs and patients are the customers and beneficiaries of general practice services). It is likely that different indicators will be deemed more or less relevant depending on the stakeholder audience. Additionally, the methodology of Delphi process relies on the perception of experts, which may entail further evidence from implementation in real practice settings.⁴⁵

Conclusion

In this study, the professional competency framework for GPs in tertiary hospitals in China was constructed using a modified Delphi method. The set of indicators describing the general roles and competencies of GPs according to the characteristics of general practice department in tertiary hospitals. This framework is expected to be used in medical education, general practice research, quality improvement, and more broadly within the health care system by self-evaluation by GPs and multi-source feedback by others who work with GPs.

Abbreviations

PHC, primary health care; GPs, General Practitioners; SD, standard deviation; SPSS,

1 2	
3	Statistical Package for Social Science: WONCA, the World Organization of Family Doctors
4 5	Statistical I dekage for Social Science, worker, the work organization of Fahiny Doctors.
6	Authors' contributions
7 8	YW and QMC designed the study. YHA, WF, and DZ participated in study and data collection. All
9 10	authors constructed and revised the Delphi questionnaire. YW and DWW analyzed the data and
11 12	wrote the manuscript. QMC reviewed and revised the manuscript. All authors read and approved
13 14	the final manuscript.
15 16	Patient and public involvement
17 18	Patients and/or the public were not involved in the design, or conduct, or reporting, or
19 20	dissemination plans of this research.
21	Patient consent for publication
23	Not applicable
24 25	Ethics approval and consent to participate
26 27	None required. We sought advice from the Ethical Committee of Capital Medical University,
28 29	Beijing, China, who considered that this study did not require formal ethical approval. Verbal
30 31	informed consents were achieved from all the participants in this study.
32 33	Funding
34 35	This study was not supported by any source of funding
36	Competing interests
37 38	Competing interests
39	The authors declare that they have no competing interests.
40 41	Data availability statement
42 43	All data relevant to the study are included in the article or unloaded as sumplementary information
44	An data relevant to the study are included in the article of uploaded as supplementary information.
45	
40	
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Characteristics	Frequency	Percentage (%)
Gender		
Male	3	15.8
Female	16	84.2
Age, years		
30-39	1	5.3
40-49	6	31.6
≥ 50	12	63.2
Professional field		
Directors of general practice departments	12	63.2
GPs in tertiary hospital	3	15.8
Researchers	3	15.8
Government administrator		5.3
Working years		
< 5	5	26.3
5-10	8	42.1
> 10	6	31.6
Highest degree		
Bachelor	1	5.3
Master	10	52.6
PhD	8	42.1
Professional title*		
Middle grade title	0	0.0
Associate senior grade title	3	15.8
Senior grade title	16	84.2

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Training experience (multiple choice)		
On-job training	14	73.7
Standardized residency training	2	10.5
Other training [#]	16	84.2
No training experience	0	0.0

Abbreviation: GP, general practitioner; PhD, doctor of philosophy

*Note: medical professional titles include junior grade, middle grade, associate senior grade and senior grade titles, which are based upon work experience and research achievement of health professional

[#] Note: There are also faculty training, continuing education, and training for 100 outstanding general practitioners in the field of general practice.

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				Table	2. Expert au	thority coefficie	nt of Delphi	survey	36 on 4 ding fo	Pound '	<u>,</u>	
	_			Round I	Feasibili	tv			4 Mar E	Round	- Feasibili	tv
Indicators		Importan	<u>ICe</u>					Importance	rch 20 nseié		2	.,
Primary	W	χ2	P	W	χ2	P	W	χ2	D25. D heme	W	χ2	
indicators	0.463	26.37	<0. 001	0.349	19.89	<0. 001	0.489	27.89	ຊີ່ອີງສັງຊີ01 ເອີ້ອງອີກ	0.467	26.63	0.
Secondary indicators	0.445	109.84	<0. 001	0.256	63.23	<0. 001	0.387	80.88	Noaced Uperieu And o	0.337	70.43	0.
Tertiary indicators	0.402	358.73	<0. 001	0.269	240.63	<0. 001	0.285	287.07	da G001 m	0.243	245.04	0.
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Page 24 of 32

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5			Table 3	3. Results of the	Delphi pro	cess	on v ng fc	D		
7	Primary		Im	Rou		aibility		Kou	Ecosibility	
8 9	indicator	Secondary and tertiary indicators	Media	Agreement	- <u>Fea</u> Median	Agreement	Medianie 20	Agreement	Median	Agreement
10 11 12 13	1. Medical services	1.1 Clinical knowledge and skills ▲ 1.1.1 Be with in-depth knowledge of clinical medicine	-	-	-	-	25. Downling ated to tex	100%	9	100%
14 15		▲ 1.1.2 Be with in-depth knowledge of general practice	-	-	-	-	perieu 9 9	100%	9	100%
16		1.1.3 History taking	9	100%	9	100%	9 dation	100%	9	100%
17		1.1.4 Physical examination	9	94.7%	9	100%		100%	9	100%
18		1.1.5 Clinical test	9	100%	9	100%	9 inii	100%	9	100%
19		1.1.6 Basic clinical operation skill	9	100%	9	100%	^y ng, -	100%	9	100%
20 21		1.1.7 Diagnosis and differential diagnosis	9	100%	9	100%	9 Al tra	100%	9	100%
22 23 24		1.1.8 Medical record writing 1.2 Diagnosis and treatment	9	100%	9	100%	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	100%	9	100%
24 25 26		1.2.1 Manage diseases at early stage presenting in an undifferentiated way	9	100%	9	100%	9 and s	100%	9	100%
27 28		1.2.2 Treat patients with common diseases/symptoms	9	100%	9	100%	9 imilar	100%	9	100%
29		1.2.3 Manage emergency conditions	9	100%	9	94.7%	9 tec une	100%	9	94.7%
30		1.2.4 Safe and rational use of medicines	9	100%	9	94.7%	9 h j	100%	9	94.7%
31 32 33		1.2.5 Arrange referrals to specialists or primary care when necessary1.3 Chronic disease management	9	100%	9	94.7%	ologies.	100%	9	100%
34 35		1.3.1 Setting chronic disease management goals	9	100%	9	94.7%	9 genc	100%	9	94.7%
36		1.3.2 Health education	9	100%	9	100%	9 D	100%	9	100%
37 38		1.3.3 Medication guidance	9	100%	9	94.7%	9 ib liog	100%	9	94.7%
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 Page 26 of 32

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	1.3.4 Regular follow-up	9	100%	9	100%	⁹ ng f	100%	9	100
	 1.3.5 Improving chronic disease management strategies ▲ 1.3.6 Directing community-based chronic disease management 	9	-	-	-	4 March 2 Ensei 9 9 9 9 9	100%	9	94.7
	1.4 Communication					2025 gnei 9late			
	1.4.1 Listen carefully to patients and be empathy	9	100%	9	94.7%	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	100%	9	94.7
	1.4.2 Explain things clearly and check for patients and families understanding	9	100%	9	100%	9 9 9 9	100%	9	100
	1.4.3 Discuss with patients and families about their health condition and thoughts	9	100%	9	94.7%	9 9 9 9 9 9 9	100%	9	94.7
	1.4.4 Propose treatment plan to patients and families	9	100%	9	100%	9 ining,	100%	9	100
	1.4.5 Engage patients and families in making decision of therapy plan that reflect their needs, value and goals	9	100%	9	94.7%	9 Al trainir	100%	9	94.7
	▲ 1.4.6 Communicate effectively with colleagues	-	-	6	1	9 1g, an	100%	9	100
2. Teaching	▲ 1.4.7 Communicate effectively with stuffs in primary care institutions 2.1 Theoretical lectures	-	-	-	0	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	100%	9	100
	2.1.1 Preparation and design for lectures	9	100%	9	100%	9 cc une	100%	9	100
	▲ 2.1.2 know about teaching techniques 2.1.3 Conducting theoretical lectures	- 9	- 94.7%	- 9	- 100%	9, 202 9 9 9 0 202	100% 100%	9 9	100 100
	2.2 Practical teaching			·		gies	1		
	2.2.1 Instructing trainees in clinical skills	9	100%	9	100%	9 Agen	100%	9	100
	2.2.2 Instructing trainees in medical records writing	9	100%	9	100%	9 Ce Bib	100%	9	100
	2.2.3 Instructing trainees in disease	9	100%	9	100%	9 00	100%	9	100

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Page 27 of 32				BMJ Ope	n		'bmjopen-2 1 by copyri			
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5 6		diagnosis and treatment 2.2.4 Instructing trainees in case	9	94.7%	9	100%	6 on 4 ing for	100%	9	100%
7 8 0		2.2.5 Joint theoretical lectures with primary care	9	94.7%	9	100%	March 988 r	100%	9	100%
9 10 11		2.2.6 Joint case discussion with primary care	9	100%	9	100%	9 9 9 9	100%	9	100%
12 13		2.2.7 Joint teaching patient rounds with primary care	9	100%	9	100%	9 9 9 9 9 9 9	100%	9	100%
14 15 16		2.3.1 Practice-based learning and improvement	9	94.7%	8	89.5%	aded fr erieur 9 9	94.7%	9	89.5%
17 18 19		2.3.2 Continuing medical education 2.3.3 Participating in academic activities	9 8	89.5% 84.2%	9 8	89.5% 89.5%	9 9 9 9 9	94.7% 89.5%	9 9	94.7% 89.5%
20	3. Research	3.1 Project design and declaration					., A∣			
21		3.1.1 Literature search	8	89.5%	8	89.5%	9 l tra	94.7%	9	94.7%
22 23 24		3.1.2 Literature reading3.1.3 know about the principles of	8 8	89.5% 89.5%	8 8	89.5% 84.2%	en.bmj. 9 ning, a	94.7% 94.7%	9 9	94.7% 94.7%
25 26 27		3.1.4 Writing project application form 3.2 Scientific research	8	84.2%	7	78.9%	9 ^{com/} oi	94.7%	9	89.5%
28		▲ 3.2.1 Master investigation techniques	-	-	-		אר אר אר איז	94.7%	8	94.7%
29		3.2.2 Master scientific research methods	8	89.5%	7	84.2%	8 tech	94.7%	8	94.7%
30		3.2.3 Carry out scientific research	8	73.7%	8	73.7%	9, 2 9	89.5%	8	89.5%
31		3.3 Report scientific research results					025 Iogi			
33		3.3.1 Statistical analysis of data	8	78.9%	7	73.7%	9 es . at /	94.7%	7	84.2%
34		3.3.2 Writing paper	8	84.2%	8	89.5%	9 ge	94.7%	9	84.2%
35 36 37	4 Prevention	3.3.3 Show about the scientific research achievements4.1 Disease prevention	7	73.7%	8	94.7%	9 nce Bib	94.7%	8	89.5%
38 39		4.1.1 Knowing about the risk of disease	9	100%	9	100%	9 9	100%	9	100%
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5	4.1.2 Assessing the risk of disease	9	100%	9	94.7%	9 g ling	100%	9	100%	
6	4.1.3 Intervention on the risk of disease	9	100%	9	100%	⁹ fr ¹ 4	100%	9	100%	
7	4.2 Screening 4.2.1 Early screening	9	100%	9	100%	o use Mar	100%	9	94 7%	
8 9	4.2.2 Early diagnosis	9	100%	9	100%	9 s r	100%	9	94.7%	
10	Note: Indicators in the table are modified versions after two r	ounds of	consultation; exp	perts rated	the importance a	and feaking his	of each ind	icator on a 1	–9 Likert	_
11	scale (1 = not important/feasible and 9 = very important/feasi	ble).				ed t				
12	▲ items added in the second round					o te				
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Indicators		Adjustment
Modification		
Primary indicator	-	-
Secondary indicator	1.1 Clinical skills	1.1Clinical knowledge and skills
	1.4 Doctor-patient communication	1.4Communication and Cooperat
	2.1 Practical teaching	Indicator 2.3 Merged to "
	2.3 Joint teaching with primary care	Practical teaching"
	2.4 Continuing learning	2.3 Self-directed learning
	3.1 Project design	3.1 Project design and declaration
	3.4 Writing paper and submission	3.3 Report of scientific resea results
Testiens in director	4.1 Guide disease prevention	4.1 Disease prevention
Tertiary indicator	1.2.1 Management of disease at early stages and undifferentiated disease	presenting in an undifferentia
	2.1.1 Preparation of lectures	2.1.1Preparation and design lectures
	3.4.1 Write scientific research papers	3.4.1 Writing paper
	2.2.3 Guiding management of patients	2.2.3 Instructing trainees in dise diagnosis and treatment
	2.2.4 Leading case discussions	2.2.4 Instructing trainees in c discussion
	2.3.1 Joint teaching with community	2.2.5 Joint theoretical lectures w primary care
	2.3.2 Joint case discussions with community	2.4.2 Joint case discussion w primary care
	2.3.3 Joint rounds with community	2.3.3 Joint teaching patient rou with primary care
	2.4.3 Taking part in the competition	2.4.3 Participating in acade
	actively	activities actively
	principles of research	research
	3.2.2 Know about the general methods	3.2.2 Know about scientific resea
	of research	methods
	3.3.1 Data collation	merged as "3.3.1 Statistical analy
	3.3.2 Data analysis	of data"
Deletion		
Primary indicator	-	-
Tertiary indicator		-
Addition		
Primary indicator	-	-
Secondary indicator	-	-
Tertiary indicator	1.1.1 Be with in-depth knowledge of	
	clinical medicine	
	1.1.2 Be with in-depth knowledge of general practice	
	1.3.6 Directing community-based	
	chronic disease management	suggested to added by more the
	1.4.6 Communicate effectively with	two experts
	colleagues	
	1.4.7 Communicate effectively with	
	sturis in primary care institutions	
	2.1.2 Know about teaching techniques	

Table 4. Adjustment of competency indicators after the first round of Delphi survey

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3 4	3.2.1 Know about investigation techniques
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Supplementary material 1. Final indicators in professional competency framework for general
practitioners in tertiary hospitals in China

Primary indicator	Secondary indicators	Tertiary indicators
	1.1 Clinical skills	1.1.1 Be with in-depth knowledge of clinica
		medicine
		1.1.2 Be with in-depth knowledge of general practic
		1.1.3 History taking
		1.1.4 Physical examination
		1.1.5 Clinical test
		1.1.6 Basic clinical operation skill
		1.1.7 Diagnosis and differential diagnosis
		1.1.8 Medical record writing
	1.2 Diagnosis and	1.2.1 Manage diseases at early stage presenting in a
	treatment Services	undifferentiated way
		1.2.2 Treat patients with common diseases/
		symptoms
		1.2.3 Manage emergency conditions
		1.2.4 Safe and rational use of medicines
		1.2.5 Arrange referrals to specialists or primary car
		when necessary
	1.3 Chronic disease	
	management	1.3.1 Setting chronic disease management goals
1. Medical services	-	1.3.2 Health education
		1.3.3 Medication guidance
		1.3.4 Regular follow-up
		1.3.5 Improving chronic disease management
		strategies
		1.3.6 Directing community-based chronic disease
		management
	1.4 Communication	1.4.1 Liston constitute nationts and he amounthy
	and Cooperation	1.4.1 Listen carefully to patients and be empathy
		1.4.2 Explain things clearly and check for patien
		and families understanding
		1.4.3 Discuss with patients and families about the
		health condition and thoughts
		1.4.4 Propose treatment plan to patients and familie
		1.4.5 Engage patients and families in makir
		decision of therapy plan that reflect their need
		value and goals
		1.4.6 Communicate effectively with colleagues
		1.4.7 Communicate effectively with stuffs in primar care institutions
2. Teaching	2.1 Theoretical	2.1.1 Preparation and design for lectures
0		

		2.1.2 know about teaching techniques
		2.1.3 Conducting theoretical lectures
	2.2 Practical teaching	2.2.1 Instructing trainees in clinical skills
		2.2.2 Instructing trainees in medical records writing
		2.2.3 Instructing trainees in disease diagnosis an
		treatment
		2.2.4 Instructing trainees in case discussion
		2.2.5 Joint theoretical lectures with primary care
		2.2.6 Joint case discussion with primary care
		2.2.7 Joint teaching patient rounds with primary car
	2.3 Salf directed	2.2.1 Prostice based learning and improvement
	2.5 Sen-un cettu	2.5.1 Tractice-based learning and improvement
	learning	2.2.2 Continuing medical education
		2.3.2 Continuing medical education
3 D		2.3.3 Participating in academic activities actively
3. Research	3.1 Project design and	3.1.1 Literature search
	declaration	
		3.1.2 Literature reading
		3.1.3 know about the principles of research
		3.1.4 Writing project application form
	3.2 Scientific research	3.2.1 Master investigation techniques
		3.2.2 Master scientific research methods
		3.2.3 Carry out scientific research
	3.3 Report scientific	3.3.1 Statistical analysis of data
	research results	
		3.3.2 Writing paper
		3.3.3 Scientific research achievements
4. Prevention	4.1 Disease prevention	4.1.1 Knowing about the risk of disease
	r in the second s	4.1.2 Assessing the risk of disease
		4 1 3 Intervention on the risk of disease
	4.2 Screening	4.2.1 Early screening
	ing servening	

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Developing a professional competency framework for general practitioners in tertiary hospitals in China: A modified Delphi study

Journal:	BMJ Open
Manuscript ID	bmjopen-2023-082736.R1
Article Type:	Original research
Date Submitted by the Author:	08-Dec-2024
Complete List of Authors:	 Wei, Yun; Beijing Tongren Hospital CMU, Department of General Practice An, Yanhua; Beijing Tongren Hospital CMU, Department of General Practice Cao, Qiumei; Beijing Tongren Hospital CMU, Department of General Practice Feng, Wei; Beijing Tongren Hospital CMU, Department of General Practice Wang, Dawei; Beijing Tongren Hospital CMU, Department of General Practice Zao, Dawei; Beijing Tongren Hospital CMU, Department of General Practice Yang, Dawei; Beijing Tongren Hospital CMU, Department of General Practice Zhu, Dan; Beijing Tongren Hospital CMU, Department of General Practice
Primary Subject Heading :	General practice / Family practice
Secondary Subject Heading:	Qualitative research
Keywords:	Public Hospitals < Hospitals, Public, Surveys and Questionnaires, Clinical Competence, GENERAL MEDICINE (see Internal Medicine), China

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Developing a professional competency framework for general practitioners in tertiary hospitals in China: A modified Delphi study

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STRENGTHS AND LIMITATIONS OF THIS STUDY

 \Rightarrow This study addresses the lack of evaluation tools for GPs in tertiary hospitals, which meet the competency feedback requirements for GPs in China.

 \Rightarrow This Delphi process in this study has engaged experts with a wide range of areas.

 \Rightarrow The survey response rate was good.

 \Rightarrow Although the selection of experts was appropriate for the purpose of this study, the results may have limited generalizability.

⇒ The effectiveness of the competency framework for GPs in tertiary hospitals is unknown, which may entail further evidence from implementation in real practice settings. Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Abstract

 Objective. At present, the competency of general practitioners (GPs)in tertiary hospitals has not been reported and there is no suitable competency evaluation tool. This study was conducted to develop a professional competency framework for GPs in tertiary hospitals.

Design. A modified Delphi method was adopted in the study.

Participants. Considering the expert authority, a wide range of sources, expert qualification and willingness, 20 eligible experts were invited and 19 experts agreed to participate in this study.

Results. Nineteen experts (the median age of the experts was 51 (49,57) years and 84.2% were women) participated in both two rounds of Delphi survey. From literature review, 4 primary indicators, 14 secondary indicators, and 48 tertiary indicators were identified. In the first round, all indicators achieved consensus except for the secondary indicator "3.3 Data processing", which did not achieve 70.0% agreement in both of importance (63.2% agreement) and feasibility (63.2% agreement). After the first round of Delphi survey, description of 7 secondary indicators and 11 tertiary indicators were modified. Two secondary indicators and two tertiary indicators were merged respectively. One secondary indicator was deleted due to not achieve consensus level and 7 new tertiary indicators being suggested to added by more than two experts. After the second round of Delphi survey, all three level of indicators achieved consensus in terms of importance and feasibility. Finally, the professional competency framework for GPs in tertiary hospitals in China was constructed including 4 primary indicators, 12 secondary indicators.

Conclusion. The professional competency framework for GPs in tertiary hospitals in China was successfully constructed in this study with good scientific soundness and rationality. It is expected to be used in medical education, general practice research, quality improvement, and more broadly within the health care system to reflect the competency of GPs in tertiary hospital.

Introduction

In recent years, hospital-centric health delivery system was prevailing in China, in which patients tend to seek medical services in public tertiary hospitals rather than primary health care (PHC) institutions, leading to a perception of health services as "too difficult to access and too expensive".¹ To enhance accessibility to health care, the Chinese government promulgated guidelines for building a so-called tiered health-care delivery system in 2015, wherein each level of health-care facility (tertiary, secondary, and primary) would provide services according to their designated roles.² Patients may receive treatment for common and minor illnesses at the primary or community health center level by general practitioners (GPs), with referrals to hospitals (secondary or tertiary) for more complex and severe conditions. Care across these levels is intended to be integrated and coordinated through bidirectional referral mechanisms, facilitated by the establishment of medical alliances or integrated systems.³

However, in practice, patients in China can seek care from any tier of health care provider without the need for a referral. Previous studies have consistently shown that healthcare services are predominantly utilized in tertiary hospital with a potential reason that service quality in tertiary hospitals was higher compared with primary care and secondary hospitals.^{4,5} In addition, evidence indicates deficiencies related to hypertension and diabetes, which are the most common chronic conditions encountered in PHC settings.⁶ China has substantially increased financial investment and implemented favorable policies aimed at enhancing its primary health care system, which plays a pivotal role in the prevention and management of chronic diseases. However, widespread gaps in the quality of primary health care still exist. System challenges include: the suboptimal education and training of primary health-care practitioners, a fee-for-service payment system that incentives testing and treatments over prevention, fragmentation of clinical care, and insufficient continuity of care throughout the entire health-care system. ⁶

To enhance the general medical service, strengthen the training of GPs, facilitate an

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effective and efficient healthcare system, and improve the quality of health management, the Chinese government stipulate all tertiary hospitals to establish general practice departments by 2019.⁷ The basic functions of the general practice departments in tertiary hospitals across China included: (1) providing comprehensive and coordinated medical services, encompassing diagnostic evaluation and therapeutic interventions, chronic disease management, and health education; (2) carrying out standardized residency training for GPs, including formulating training plans, outpatient and inpatient instruction, assessment, and related activities; (3) conducting scientific research in the fields of innovation of primary health service model, clinical studies related to general practice, quality improvement; (4) providing preventionoriented health services, including screening, primary prevention, health education, and self-management strategies.⁸ At present, most GPs in tertiary hospitals were doctors from other departments after the on-job training (1-year training for doctors who want to register as GP). New GPs recruited to the general practice departments in tertiary hospitals should have a PhD degree and have finished the standardized residency training (3-year rotational training after undergraduate medical education). The standardized residency training represents the primary pathway for GP training. Upon successful completion of the residency program, trainees will be eligible to register as GPs and pursue careers in community health service institutions (CHSIs) or within the general practice departments of hospitals. The standardized residency training comprises two distinct phases: (1) 30 months dedicated to hospital-based clinical rotations, and (2) 6 months focused on CHSI-based training. ^{9,10} According to statistics in 2021, there were 54,115 GPs in tertiary hospitals, (accounting for 12.4% of the total GPs in China).¹¹

Professional competency in medicine was defined as "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served" by Epstein and Hundert in JAMA.¹² In some western countries, practical competency models for GPs, such as the Family Medicine Milestone Project in the US,¹³ Workplace Based assessment and Annual Review of Competence Progression

guidance in the UK,¹⁴ the CanMEDS-FM 2017 in Canada,¹⁵ and Competency profile of the Australian general practitioner at the point of fellowship in Australia,¹⁶ have widely used in competency assessment of GPs in primary care. In China, there were studies concentrated on development of competency models for GPs in rural areas¹⁷ and GPs after standardized residency training.¹⁸

Generally, general practice provides "person-centred, continuing, comprehensive and coordinated whole person healthcare to individuals and families in their communities with common and frequently-occurring diseases".¹⁹ A multi-method study exploring the work content of GPs in primary care in Beijing indicated that GPpatient consultation with common and frequently-occurring diseases is the major part of GP work. In addition, GPs also undertake work like chronic disease management and follow-up, health file management, family doctor contract services, teaching student, etc.²⁰ In addition to outpatient medical services, GPs in tertiary hospitals also deliver inpatient diagnostic and therapeutic services, which is different from primary healthcare providers that exclusively offer outpatient care. Typically, the epidemiology of multimorbidity among the outpatients and inpatients admitted to the general practice departments of tertiary hospitals are complex. As reported in previous study, the prevalence of multimorbidity among inpatients in the general practice department of tertiary hospitals in China is extremely high, reaching 93.1%.⁷ In tertiary hospitals, in addition to providing clinical diagnosis and treatment within both outpatient and inpatient departments, GPs are also required to engage in educational activities related to standardized resident training, conduct scientific research pertinent to career advancement and professional title promotion, as well as participate in disease prevention and management initiatives. These responsibilities have established heightened expectations for the competencies of GPs working in tertiary hospitals. Given the varied backgrounds of GPs in tertiary hospitals and the current focus of competency evaluations primarily on GPs in primary care, there is a notable absence of literature addressing competency evaluation for GPs in tertiary hospitals and the associated evaluation tools. Consequently, this study aims to establish a professional competency framework for GPs in tertiary hospitals, thereby providing a reference

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point for future assessments of GP competencies.

Methods

Design

A modified Delphi method was adopted in the study, which was the most widely used method for selecting quality indicators in healthcare.^{21,22} There is no restriction on the number of rounds that can be conducted,²³ but two or three rounds are most common in previous studies. ²⁴⁻²⁶ The process concludes upon reaching a consensus regarding the topics under discussion. The Delphi study lacked definitive consensus criteria²⁷. In this study, consensus was established based on two selection parameters: a median score exceeding seven on a nine-point scale and at least 70% of panel ratings falling within the top tertile (7–9) for both importance and feasibility²⁸.

This study involved two rounds of questionnaires to an expert panel via e-mail from August to October 2022. The Delphi process was carried out in accordance with established methodologies from prior studies^{25,26} and research guideline for the Delphi survey technique,²⁹ which included two stages: (1) generating an initial set of potential competencies to be considered for inclusion in the competency model for GPs in tertiary hospitals from a systematic review; (2) conducting modified Delphi survey to prioritize and gain consensus on the most essential competencies for GPs in tertiary hospitals (Figure 1).

Figure 1 is here

Participants

The basic criteria for the selection of experts in our study include: (i) expert authority, which means the academic background related to general practice in tertiary hospitals, including roles in leading or participating in research, seminars, and academic conferences related to the establishment, positioning, and development of general practice departments; (ii) a wide range of sources, including management personnel in general practice departments in tertiary hospitals, GPs in tertiary hospitals, government administrators, or scientific researchers in the field of general practice, who possessed a comprehensive understanding of the responsibilities of GPs in tertiary hospitals; (iii) expert qualification, which refers to a senior professional title or a n associate senior

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grade title; and (iv) willingness to participate in this research. The individuals who were lack of comprehension of the functional orientation of general practice department and the responsibilities of GPs in tertiary hospitals in tertiary hospitals will be excluded. Finally, 20 eligible experts were invited by Professor Cao via E-mail and 19 experts agreed to participate in this study.

Questionnaire preparation

Four primary competency indicators (medical services, teaching, research, and prevention) were determined based on the basic functions of the general practice departments in tertiary hospitals.⁸ A preliminary list of secondary and tertiary competency indicators was constructed by literature review. Literature was searched in PubMed and three Chinese databases (China National Knowledge Infrastructure, Wanfang Data, Database of Chinese sci-tech periodicals) with terms commonly used to describe GP (e.g., general practitioner, family physician, family doctor), tertiary hospital (e.g., tertiary hospital, general hospital, hospital), competency (e.g., competence, ability). Furthermore, policy documents related to GP in tertiary hospitals across China were also reviewed to extract competency indicators. Finally, a total of 31 published research papers describing domestic and foreign GPs' competencies were identified form literature review, which included 5 published competency models from international general practice organizations. In addition, 3 published policy documents about general practitioner system in China were also reviewed (references of these papers and policies were shown at supplementary material 1).

Potential competency indicators were extracted and screened by 2 reviewers (YW and YHA) according to following criteria: (a) the indicators were applicable to measure the competency of GPs in tertiary hospitals; (b) the indicators were relevant to requirements of GPs' work in tertiary hospitals in China; (c) the indicators were relevant to development of GPs in tertiary hospitals. When there were doubts about whether an indicator should be retained, the research team would discuss together to make a decision. There were 74 competency indicators identified by the screening process. After deleting duplicate competency indicators, integrating the indicators with similar dimensions, and classifying them into three hierarchical levels based on their

connotations, a preliminary professional competency framework for GPs in tertiary hospitals in China was conducted including 4 primary indicators, 14 secondary indicators and 48 tertiary indicators (Supplementary material 2).

All indicators in the preliminary professional competency framework for GPs in tertiary hospitals in China were formatted into Delphi questionnaire. Importance pertains to the significance of the indicator in reflecting the competencies of GPs and feasibility pertains to the accessibility of information concerning evaluation outcomes during the actual evaluation process, which were both rated on a 1-9 Likert scale (1 = not important/feasible at all; 9 = very important/feasible)^{27,28}. Spaces were left for experts to make comments on these existing competency indicators or recommend new competency indicators which they considered should be included in.

Delphi survey

First round. The first round of Delphi survey was performed in 4 weeks in August 2022. The first-round questionnaire was sent to experts by e-mail, along with materials about the research background, the aim of the study, the demographic information collection form, instructions of scoring criteria, and descriptions of the indicators. In the first-round questionnaire, experts were asked to rate the importance and feasibility of each competency indicator using the 1-9 Likert scale, give their comments on the existing indicators, and recommend new competency indicators which they considered should be included in.

After the first round of Delphi survey, data was collected and analyzed. The median and the distribution of scores (frequency count of answer choices), as well as comments were reported. The rating result of each level of competency indicators and comments were discussed after the round one feedback. Competency indicators achieving consensus level or being modified based on experts' comments were retained for the second round of Delphi survey. New indicators were added into second-round questionnaire based on the suggestion by more than two experts. Indicators were removed which did not achieved consensus level or were recommended to be removed by more than 2 experts.^{25,30}

Second round. The second round of Delphi survey was conducted from September to

October 2022, spanning a duration of 4 weeks. The competency indicators confirmed in the first round of Delphi survey were formulated into the second-round questionnaire, which was sent to the same experts with the first-round survey by e-mail, accompanied by a graph-based report detailing the results from the first round. Importance and feasibility of each level of competency indicators were rated using the same 1-9 Likert scale as in the first round. In this round of survey, participants were also given a chance to suggest additional competency indicators, argue for or against proposed competency indicators, and comment on competency indicators wording and comprehension.

Statistical analysis

The database was established and inputted by two researchers simultaneously using Epidata 3.0. If there was any difference or error, the third researcher would check and correct it. Descriptive analysis was used to describe the characteristics of participants and results. Median and interquartile range (IQR) were used to report continuous variables, while frequencies (%) were used to report categorical variables. The median and the distribution of scores (frequency count of answer choices) were used to report the rating result of each indicator. The Data management and analysis were performed using Statistical Package for Social Science (SPSS), version 22.0. All qualitative feedback from experts will be systematically extracted and categorized into distinct groups, encompassing revisions to the descriptions of indicators, proposed deletions of certain indicators, and suggestions for new indicators to be added. The occurrence frequency of identical suggestions will be recorded.

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Results

Panel characteristics in Delphi survey

All of the 19 experts participated in both two rounds of Delphi survey, with 16 female participants (84.2%) and 3 male participants (15.8%). The median age of the experts was 51 (49,57) years. Among them, 15 experts were from Beijing, 2 experts were from Zhejiang Province, one from Guangdong Province, and one from Hainan Province. Directors of general practice departments in tertiary hospitals accounted for 63.2%, GPs in tertiary hospitals accounted for 15.8%, researchers in the field of general practice accounted for 15.8%, and there was one government administrator (5.3%). There were

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94.7% experts had master or PhD degree and 100% experts were with senior grade title. The median duration of experience in general practice was 7 (5,14) years, with 26.3% experts working for less than 5 years, 42.1% experts working for 5-10 years, and 31.6% experts working for over 10 years in this field. There were 73.7% experts had participated in the on-job training, 10.5% experts had participated in the standardized residency training, and 84.2 % had participated in other training (faculty training of general practice) (Table 1).

Table 1 is here

First round

In the first round, the median of scores of importance and feasibility for all primary and secondary competency indicators were ranged from 7.00 to 9.00. As shown in table 2, all primary indicators reached consensus with the exception of indicator "3. Research", which failed to attain a 70.0% agreement in terms of feasibility (63.2% of experts rating in the top tertile with 7-9). Considering that the importance and feasibility rating of the secondary and tertiary indicators within the scope of indicator "3. Research" achieved consensus, it was retained to the second round of expert consultation. All secondary indicators achieved consensus except for indicator "3.3 Data processing", which failed to attain 70.0% agreement in both of importance (63.2% agreement) and feasibility (63.2% agreement). No tertiary competency indicators failed to attain consensus in the first round. The median scores of importance and feasibility ranged from 7.00 to 9.00 and 7.00 to 9.00, respectively. The percentage of panel ratings in the top tertile (7–9) for importance and feasibility ranged from 73.7% to 100% (Supplementary material 3).

Table 2 is here

Adjustment of all three hierarchical levels of competency indicators after the first round of Delphi survey was shown in table 3. Description of 7 secondary indicators and 11 tertiary indicators were modified. Secondary indicator "2.3 Joint teaching with primary care" was merged into secondary indicator "2.2 Practical teaching ". Tertiary indicator "3.3.1 Data collation" and tertiary indicator "3.3.2 Data analysis" are merged

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as "3.3.1 Statistical analysis of data". One secondary indicator "3.3 Data processing" was deleted due to not achieve consensus level. There were 7 new tertiary indicators being suggested to added by more than two experts and hence included in the second round.

Table 3 is here

Second round

At this step, 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators were evaluated, including retained, modified, and new competency indicators. In the second round, the median values of importance and feasibility scores for three hierarchical levels of indicators were 7.00-9.00 and 7.00-9.00, respectively. The percentages of panel ratings in the top tertile (7–9) about importance and feasibility were 89.5%-100% and 84.2%-100% for 4 primary indicators, $84.2\% \sim 100\%$ and $84.2\% \sim 100\%$ for the 12 secondary indicators (Table 2), $89.5\% \sim 100\%$ and $84.2\% \sim 100\%$ for the 54 tertiary indicators (Supplementary material 3). As a result, all competency indicators achieved consensus in terms of importance and feasibility in this round.

After two rounds of Delphi survey, the professional competency framework for GPs in tertiary hospitals in China was constructed, which included: 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators (Supplementary material 4).

Discussion

Main finding

This study presents the results of the development of a professional competency framework for GPs in tertiary hospitals in China, in which 4 primary indicators, 12 secondary indicators, and 54 tertiary indicators reached consensus after two rounds of the Delphi survey.

Comparison to previous competency frameworks

The indicators of the professional competency framework for GPs in tertiary hospitals across China were developed focusing on the current functions of the general practice departments of tertiary hospitals and were applicable to the whole country.⁸ In 2018, Chinese government began requiring all tertiary hospitals to establish general practice departments and designating them as engines for increasing general medical

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service capacity and quality. The patients admitted to the general practice departments of tertiary hospitals in China were mostly suffering from chronic diseases and multimorbidity.⁷ Patients with multimorbidity face reduced quality of life, prolonged hospital stay, increased number of readmissions, increased emergency visit rate, high incidence of multiple medications, adverse drug events, etc.³¹⁻³⁴ Therefore, the medical service ability was important and primary for GPs in tertiary hospitals, including clinical knowledge and skills, diagnosis and treatment, chronic disease management, and communication. As described in previous competency model in America, general practice demands a broad and deep fund of knowledge to proficiently care for a diverse patient population with undifferentiated health care needs.¹³ Disease diagnosis and treatment and chronic disease management are the basic tasks of GPs as in WONCA tree.³⁵ Besides, effective communication was crucial to doctor-patient relationship.³⁶ For general practice, communication and empathy are essential in patient-centered care,³⁷ which was proved by CanMEDS-FM 2017 in Canada,¹⁵ the family medicine milestone project in America.¹³ and competency profile of the Australian general practitioner at the point of fellowship in Australia.¹⁶

In comparison to the foreign competency models for GPs in America,¹³ Australia,¹⁶ and Europe,³⁵ the professional competency framework for GPs in tertiary hospitals in China imposes more stringent requirements regarding teaching. As clinical residential training bases, general practice department in tertiary hospitals need to undertake tasks about teaching and training, including taking the lead in formulating and implementing training plans, carrying out outpatient and ward teaching, cooperating with primary care institutions in teaching.⁸ Although teaching ability is also emphasized in the CanMEDS role of Scholar,¹⁵ teaching activities and competence requirements of GPs in tertiary hospitals in China are mainly focused on clinical practice, thus facilitating the transition of residency trainees from theoretical knowledge to practical application. Furthermore, aside from a few trainees engaged in the general practice department in tertiary hospitals, the majority of trainees pursue their careers within primary care institutions after residency training. Consequently, the ability of joint teaching with primary care is crucial not only for aiding students in mastering clinical skills in hospitals but also for

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considering the case characteristics and diagnostic approaches relevant to primary healthcare.

GPs in tertiary hospitals appreciate the importance of research, actively engaging in and applying it within their practice to ensure they remain competent to deliver highquality, evidence-based care that supports positive patient and population health outcomes. The scientific research capabilities of GPs are also closely linked to continuing medical education and continuing professional development in China.³⁸ Similar to the CanMEDS role of Scholar,¹⁵ competencies related to research design, implementation, and the translation of research findings have been underscored in the competency framework for GPs in tertiary hospitals, which are not adequately represented in competency models from America,¹³ Australia,¹⁶ and Europe.³⁵

Another important indicator of professional competency framework for GPs in tertiary hospitals in China was prevention. The provision of effective preventive care aims to reduce preventable morbidity and mortality, enhance quality of life and decrease an individual's need generally for medical services.³⁹ Since the mid-1990s professional bodies have argued that prevention should be a constituent element of normal professional practice of GPs and nurses and that prevention and health promotion should be an integral part of general practice.⁴⁰ GPs can positively influence their patient's lifestyle choices, and encourage and equip them to take a greater interest in, and greater responsibility for, their own health.⁴¹ Same as the family medicine milestone project in America,¹³ the role of health advocate as outlined in CanMEDS from Canada,¹⁵ and the competency profile of Australian general practitioner at the point of fellowshi,¹⁶ disease prevention, encompassing screening and health risks management, constitutes a critical component of competency evaluation of GPs in tertiary hospitals across China.

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Compared with previous competency models of GPs in China, there are some similarities and differences. GPs' abilities about medical service and doctor-patient communication were emphasized in either of the professional competency framework for GPs in tertiary hospitals or previous competency models for GPs.^{17,18} Although teaching and research were also indicated in the competency model for GPs after

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standardized residency training,¹⁸ the evaluation standards will be higher and more stringent for GPs in tertiary hospitals. In addition, GPs' teaching ability for the residency trainees and joint teaching with primary care were emphasized in the professional competency framework for GPs in tertiary hospitals. Besides, it is notable that there are two aspects special in PHC in China: basic public health service and "family doctor contract" services. An independent domain of "Basic public health service" and "teamwork" were identified in previous competency models for GPs.^{17,18} Another difference was the indicator "prevention", which was firstly included in the competency model for GPs in China in this study as an independent and primary indicator.

Strengths and limitations

In most health service systems, GPs are classified as primary health care providers. However, in the unique healthcare landscape of China, GPs in tertiary hospitals play a multiple role of medical service provider, GP trainer, researcher, and preventive service provider.⁸ This is the first study to explore the competency content of GPs in tertiary hospitals, which is helpful to reflect the competence of GPs and improve the quality of general practice service in China. Additionally, a modified Delphi method was adopted, through which, diverging expert assessments and opinions become transparent and ultimately resolved and consented upon.⁴² The involvement and positive coefficient about experts in this study are commendable.

A potential limitation of this study is the narrow geographical diversity of respondents. Experts in this study were mostly from Beijing and the proportion of experts in other provinces was low. They may not adequately represent the full spectrum of views held by individuals in different regions across China. Another limitation of this study is that, despite our efforts to recruit male participants, the majority of participated experts were female. This imbalance can be attributed to the predominance of female practitioners in clinical medicine and medical education in China, particularly within the fields of internal medicine, gynecology, pediatrics, and general practice. Additionally, though the steering group included a broad range of representatives, some stakeholders may have been underrepresented. For example,

 nurses in general practice department and patients were not represented (as nurses are collaborators with GPs and patients are the customers and beneficiaries of general practice services). It is likely that different indicators will be deemed more or less relevant depending on the stakeholder audience. Finally, the methodology of Delphi process relies on the perception of experts, which may entail further evidence from implementation in real practice settings.⁴³

Conclusion

In this study, the professional competency framework for GPs in tertiary hospitals in China was constructed using a modified Delphi method. The set of indicators describing the roles and competencies of GPs according to the characteristics of general practice department in tertiary hospitals. This framework is expected to be used in medical education, general practice research, quality improvement, and more broadly within the health care system by self-evaluation by GPs or multi-source feedback by others who work with GPs.

Abbreviations

PHC, primary health care; GPs, General Practitioners; SD, standard deviation; SPSS, Statistical Package for Social Science; WONCA, the World Organization of Family Doctors. Authors' contributions

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YW and QMC designed the study. YHA, WY, and QMC participated in Delphi questionnaire preparation and data collection. All authors collaboratively developed and refined the Delphi questionnaire. The database was established and inputted by WF, DZ, and DWW. QMC would check and correct it If there was any difference or error. YW wrote the manuscript and revised it according to the reviewer's comments. QMC reviewed and revised the manuscript. All authors read and approved the final manuscript. QMC acted as guarantor.

Patient and public involvement

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

Patient consent for publication

Not applicable

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Ethics approval and consent to participate

None required. We sought advice from the Ethical Committee of Capital Medical University, Beijing, China, who considered that this study did not require formal ethical approval. Verbal informed consents were achieved from all the participants in this study.

Funding

This study was not supported by any source of funding

Competing interests

The authors declare that they have no competing interests.

Data availability statement

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

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Characteristics	Frequency	Percentage (%)
Gender		
Male	3	15.8
Female	16	84.2
Age, years		
30-39	1	5.3
40-49	6	31.6
≥ 50	12	63.2
Professional field		
Directors of general practice departments	12	63.2
GPs in tertiary hospital	3	15.8
Researchers	3	15.8
Government administrator	.1	5.3
Working years		
< 5	5	26.3
5-10	8	42.1
> 10	6	31.6
Highest degree		
Bachelor	1	5.3
Master	10	52.6
PhD	8	42.1
Professional title*		
Intermediate grade title	0	0.0
Deputy senior grade title	3	15.8

Table 1. Panel characteristics of the	Delphi process (n=19)
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On-job training	14	73.7
Standardized residency training	2	10.5
Other training [#]	16	84.2
No training experience	0	0.0

Abbreviation: GP, general practitioner; PhD, doctor of philosophy

*Note: In China, the professional titles for physicians are categorized into four distinct levels: junior grade (resident physician), intermediate grade (attending physician), deputy senior grade (deputy chief physician), and senior grade (chief physician). These classifications are determined by the healthcare professionals' work experience and research accomplishments.

* Note: There are also faculty training, continuing education, and training for 100 outstanding general practitioners in the field of general practice.

comj	petency indicat	ors		
Competency indicators	Rou	nd 1	Rour	nd 2
Competency indicators	Importance	Feasibility	Importance	Feasit
1. Medical services	100%	100%	100%	100
1.1 Clinical knowledge and skills	100%	100%	100%	100
1.2 Diagnosis and treatment	100%	100%	100%	100
1.3 Chronic disease management	94.7%	94.7%	100%	100
1.4 Communication	100%	100%	100%	100
2. Teaching	94.7%	100%	100%	100
2.1 Theoretical lectures	100%	100%	100%	100
2.2 Practical teaching	100%	100%	1000/	100
2.3 Joint teaching with primary care#	100%	100%	100%	100
2.4 Self-directed learning	94.7%	84.2%	94.7%	84.2
3. Research	78.9%	63.2%	89.5%	84.2
3.1 Project design and declaration	73.7%	73.7%	89.5%	89.5
3.2 Scientific research	73.7%	78.9%	89.5%	89.5
3.3 Data processing*	63.2%	63.2%	-	-
3.4 Write paper and submission	73.7%	78.9%	84.2%	84.2
4. Prevention	100%	94.7%	100%	94.7
4.1 Disease prevention	100%	100%	100%	94.7
4.2 Screening	100%	100%	100%	84.2

Note: Indicators in the table are modified versions before two rounds of consultation; experts rated the importance and feasibility of each indicator on a 1-9 Likert scale (1 = not important/feasible and 9 = very important/feasible).

Secondary indicator "2.3 Joint teaching with primary care" was merged into secondary indicator "2.2 Practical teaching" after round one.

* Secondary indicator "3.3 Data processing" was deleted due to not achieve consensus level after round one.

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Table 3. Adjustment of competency	indicators after the first round of	f Delphi survev
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Indicators		Adjustment
Modification		2
Primary indicator	-	-
Secondary indicator	1.1 Clinical skills	1.1Clinical knowledge and skills
	 1.4 Doctor-patient communication 2.1 Teaching theory and method 2.2 Practical teaching 2.3 Joint teaching with primary care 2.4 Continuing learning 3.1 Project design 3.4 Writing paper and submission 	 1.4Communication and Cooperatio 2.1 Theoretical lectures Indicator 2.3 Merged to "2. Practical teaching" 2.3 Self-directed learning 3.1 Project design and declaration 3.3 Report of scientific researce
		results
Tertiary indicator	4.1 Guide disease prevention1.2.1 Management of disease at early stages and undifferentiated disease	4.1 Disease prevention 1.2.1 Manage diseases at early stag presenting in an undifferentiate way
	2.1.1 Preparation of lectures	2.1.1Preparation and design to lectures
	2.2.3 Guiding management of patients	2.2.3 Provide instruction to trainee in disease diagnosis and treatment
	2.2.4 Leading case discussions	2.2.4 Provide instruction to trainee in case discussion
	2.3.1 Joint teaching with community	2.2.5 Conduct joint theoretical lectures with primary care
	2.3.2 Joint case discussions with community	2.4.2 Conduct joint case discussion with primary care
	2.3.3 Joint rounds with community	2.3.3 Conduct joint teaching patien rounds with primary care
	 2.4.3 Taking part in the competition actively 3.2.1 Know about the general principles of research 3.2.2 Know about the general methods of research 3.3.1 Data collation 3.3.2 Data analysis 3.4.1 Write scientific research papers 	2.4.3 Participate in academi activities actively 3.1.3 Know about the principles of research 3.2.2 Know about scientific research methods merged as "3.3.1 Statistical analysi of data" 3.4.1 Write paper
Deletion	5.4.1 write scientific research papers	5.4.1 White puper
Primary indicator Secondary indicator Tertiary indicator Addition	- 3.3 Data processing	- did not achieve consensus level -
Primary indicator	-	-
Secondary indicator	-	-
Tertiary indicator	 1.1.1 Be with in-depth knowledge of clinical medicine 1.1.2 Be with in-depth knowledge of general practice 1.3.6 Direct community-based chronic disease management 1.4.6 Communicate effectively with colleagues 1.4.7 Communicate effectively with 	suggested to added by more tha two experts

2 3	stuffs in primary care institutions
4 5 6	2.1.2 Know about teaching techniques 3.2.1 Know about investigation techniques
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Figure Legend(s)

Figure 1. Flow diagram of the process of developing a professional competency framework for GPs in tertiary hospitals in China. GPs, general practitioners; IQR, interquartile range.

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Supplementary file 1. References of the 34 papers by literature review

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Supplementary material 2. Preliminary professional competency framework for GPs in tertiary
hospitals in China

Primary indicator	Secondary indicators	Tertiary indicators	source	
	1.1 Clinical skills	1.1.1 History taking	Literature	
		1.1.2 Physical examination	Literature	
		1 1 3 Clinical test	Literature	
		1.1.4 Basic clinical operation skill	Literature	
		1 1 5 Diagnosis and differential diagnosis	Literature	
		1 1 6 Medical record writing	Literature	
	1.2 Diagnosis and	1.2.1 Management of disease at early	Literature	
	treatment Services	stages and undifferentiated disease	& Policy	
		1.2.2 Treat outpatient and inpatient	Policy	
		1.2.3 Manage emergency conditions	Policy	
		1.2.4 Safe and rational use of medicines	Literature	
		1.2.5 Arrange referrals to specialists or	Literature	
		primary care when necessary	& Policy	
	1.3 Chronic disease	1.3.1 Setting chronic disease	Literature	
	management	management goals	& Policy	
1 Medical		1.2.2 Health advantian	Literature	
services		1.3.2 Health education	& Policy	
services		1.3.3 Medication guidance	Literature	
		1.3.4 Regular follow up	Literature	
		1.5.4 Regular lonow-up	& Policy	
		1.3.5 Improving chronic disease	Literature	
		management strategies	Enterature	
	1.4 Doctor-patient	1.4.1 Listen carefully to patients and be	Literature	
	communication	empathic	2110101010	
		1.4.2 Explain things clearly and check for	Literature	
		patients and families understanding		
		1.4.3 Discuss with patients and families	Literature	
		about their health condition and thoughts		
		1.4.4 Propose treatment plan to patients	Literature	
		1.4.5 Engage notionts and families in		
		making decision of therapy plan that	Literature	
		reflect their needs value and goals	Literature	
2. Teaching	2.1 Teaching	2 1 1 Preparation of lectures	Literature	
2. Teaching	theory and method	2.1.2 Conducting theoretical lectures	Literature	
	2.2 Practical	2.2.1 Instructing trainees in clinical skills	Literature	
	teaching		& Policy	
	8	2.2.2 Instructing trainees in medical	Literature	
		records writing	& Policy	
		2.2.3 Guiding management of patients	Literature	

			& Policv
		2.2.4 Leading case discussions	Literature
		2.2. Theading case discussions	& Policy
	2.3 Joint togohing	2.2.1 Joint togehing with community	Litoroturo
	2.5 Joint teaching	2.5.1 Joint teaching with community	
	with primary care	222 Lint and diamatican with	
		2.3.2 Joint case discussions with	
		community	& Policy
		2.3.3 Joint rounds with community	Literature
			& Policy
	2.4 Continuing	2.4.1 Practice-based learning and	Literature
	learning	improvement	
		2.4.2 Continuing medical education	Literature
		2.4.3 Taking part in the competition	D 1'
		actively	Policy
3. Research	3.1 Project design	3.1.1 Literature search	Literature
	, i ji i i ji i i i ji i i i i i i i i i	3.1.2 Literature reading	Literature
		3.1.3 Writing project application form	Policy
	2.2 Saiantifia	2.2.1 Know about the general principles	I itoroturo
	5.2 Scientific	5.2.1 Know about the general principles	Literature
	research		т.,
		3.2.2 Know about the general methods of	Literature
		research	
		3.2.3 Carry out scientific research	Literature
	3.3 Data processing	3.3.1 Data collation	Literature
		3.3.2 Data analysis	Literature
	3.4 Write scientific	3.4.1 Write scientific research papers	Literature
	research papers	3.4.2 Scientific research achievements	Literature
4. Prevention	4.1 Disease	4.1.1 Knowing about the risk of disease	Literature
	prevention		& Policy
	Provension	4.1.2 Assessing the risk of disease	Literature
		4.1.2 Assessing the fisk of discuse	& Policy
		4.1.2 Intervention on the risk of discose	Literatura
		4.1.3 Intervention on the fisk of disease	
			& Policy
	4.2 Screening	4.2.1 Early screening	Literature
			& Policy
		4.2.2 Early diagnosis	Literature
			& Policy

	Supp	BMJ Open Supplementary material 3. Results of the Delphi process			bmjopen-2023-082736 o J by copyright, including					
		Round 1			Round 2					
Primary indicator	Secondary and tertiary indicators	Importance I		Fea	asibility	I∰ngostance		Feasibility		
	Secondary and ternary indicators	Median	Agreement (7-9)	Median	Agreement (7-9)	Median	Agreement (7-9)	Median	Agreement (7-9)	
1. Medical services	1.1 Clinical knowledge and skills ▲ 1.1.1 Possess comprehensive expertise in clinical medicine	-	-	-	-	5. Downl ement Su 9 tex	100%	9	100%	
	▲ 1.1.2 Possess comprehensive expertise in general practice	-	-	-	-	9 9 9 9 9 9 9	100%	9	100%	
	1.1.3 History taking	9	100%	9	100%	9 dat (1 fro	100%	9	100%	
	1.1.4 Physical examination	9	94.7%	9	100%		100%	9	100%	
	1.1.5 Clinical test	9	100%	9	100%		100%	9	100%	
	1.1.6 Basic clinical operation skill	9	100%	9	100%	9 ng , •	100%	9	100%	
	1.1.7 Diagnosis and differential diagnosis	9	100%	9	100%	9 Al tra	100%	9	100%	
	1.1.8 Medical record writing	9	100%	9	100%	9 ini 	100%	9	100%	
	1.2 Diagnosis and treatment					Ű, Ö				
	1.2.1 Manage diseases at early stage presenting in an undifferentiated way	9	100%	9	100%	9 si	100%	9	100%	
	1.2.2 Treat outpatient and inpatient	9	100%	9	100%	9 mii 9	100%	9	100%	
	1.2.3 Manage emergency conditions	9	100%	9	94.7%	9art Ju	100%	9	94.7%	
	1.2.4 Safe and rational use of medicines	9	100%	9	94.7%	9 ech	100%	9	94.7%	
	1.2.5 Arrange referrals to specialists or primary care when necessary 1.3 Chronic disease management	9	100%	9	94./%	9, 2025 ; Inologie	100%	9	100%	
	1.3.1 Help patients set chronic disease management goals	9	100%	9	94.7%	9 ⁹ .	100%	9	94.7%	
	1.3.2 Health education	9	100%	9	100%	9 nce	100%	9	100%	
	1.3.3 Medication guidance	9	100%	9	94.7%	9 B	100%	9	94.7%	
	1.2.4 Decaylor fellow yr	9	100%	9	100%	9 ^b lio	100%	9	100%	
e 37 of 40	BMJ Open Sp									
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		1.3.5 Help patients improve chronic disease management strategies	9	100%	9	100%	ding f	100%	9	100%
		▲ 1.3.6 Direct community-based chronic disease management 1.4 Communication	-	-	-	-	4 March 2 Ensei 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	100%	9	94.79
		1.4.1 Listen carefully to patients and be empathic	9	100%	9	94.7%	2025. D gneme Plated	100%	9	94.79
		1.4.2 Explain things clearly and check for patients and families understanding	9	100%	9	100%	9 9 9 9 9 9 9 9 9 9	100%	9	1009
		1.4.3 Discuss with patients and families about their health condition and thoughts	9	100%	9	94.7%	9 9 9 9 9 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9	100%	9	94.7
		1.4.4 Propose treatment plan to patients and families	9	100%	9	100%	9 9 9 9 1 1 1 9 1 1 1 1 9 1 1 1 1 1 1 1	100%	9	1009
		1.4.5 Engage patients and families in making decision of therapy plan that reflect their needs, value and goals	9	100%	9	94.7%	9 ⁹ 999, 1	100%	9	94.7
		▲ 1.4.6 Communicate effectively with colleagues	-	-0		-	njope 9 train	100%	9	1009
2	2. Teaching	▲ 1.4.7 Communicate effectively with stuffs in primary care institutions 2.1 Theoretical lectures	-	-	9	1,	n.bmj.co ⁹ g, and	100%	9	1009
	U	2.1.1 Preparation and design for lectures	9	100%	9	100%	sim و الم	100%	9	1009
		▲ 2.1.2 know about teaching techniques	-	-	-	100%	ilar te	100% 100%	9 9	1009
		2.7.9 Conduct medication focules	9	94.770	9	10070	e 9, chn	10070	,	100
		2.2.1 Provide instruction to trainees in clinical skills	9	100%	9	100%	ologie	100%	9	1009
		2.2.2 Provide instruction to trainees in medical records writing	9	100%	9	100%	s. 9	100%	9	1009
		2.2.3Provide instruction to trainees in disease diagnosis and treatment	9	100%	9	100%	9 e Bi	100%	9	1009
		2.2.4 Provide instruction to trainees in	9	94.7%	9	100%	<u> </u>	100%	9	1009
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3 4 5		case discussion					cludin			
5 6 7		2.2.5 Conduct joint theoretical lectures with primary care	9	94.7%	9	100%	9 for u	100%	9	100%
, 8 9		2.2.6 Conduct joint case discussion with primary care	9	100%	9	100%	99 99 98 re	100%	9	100%
10 11 12		2.2.7 Conduct joint teaching rounds with primary care 2.3 Self-directed learning	9	100%	9	100%	gnemen 9 9	100%	9	100%
13 14		2.3.1 Practice-based learning and improvement	9	94.7%	8	89.5%	99 99 91 91 91 91 91 91 91 91 91 91 91 9	94.7%	9	89.5%
15		2.3.2 Continuing medical education	9	89.5%	9	89.5%	9 gind	94.7%	9	94.7%
16 17		2.3.3 Participate in academic activities actively	8	84.2%	8	89.5%	9ata r 9ata r	89.5%	9	89.5%
18	3. Research	3.1 Project design and declaration					nin			
19		3.1.1 Literature search	8	89.5%	8	89.5%	9 ing ,	94.7%	9	94.7%
20		3.1.2 Literature reading	8	89.5%	8	89.5%	9≥	94.7%	9	94.7%
21 22		3.1.3 know about the principles of research	8	89.5%	8	84.2%	9 9 9 9 9	94.7%	9	94.7%
25 24 25		3.1.4 Write project application form 3.2 Scientific research	8	84.2%	7	78.9%	99, an	94.7%	9	89.5%
25		▲ 3.2.1 Master investigation techniques	_	-	_	<u> </u>	8 <u>si</u> 8	94.7%	8	94.7%
27		3.2.2 Master scientific research methods	8	89.5%	7	84.2%	8 mii on	94.7%	8	94.7%
28		3 2 3 Carry out scientific research	8	73 7%	8	73 7%	9 ta	89.5%	8	89.5%
29		3.3 Report of scientific research results	-		-		ne y echi)	-	
30 31		3 3 1 Statistical analysis of data	8	78 9%	7	73 7%		9 4 7%	7	84 2%
32		3.3.2 Write paper	8	84.2%	8	89.5%		94.7%	9	84.2%
33		3.3.3 Show about the scientific research	7	73.7%	8	94.7%	9 .	94.7%	8	89.5%
34		achievements					Age Age			
35	4. Prevention	4.1 Disease prevention					inc			
36		4.1.1 Know about the risk of disease	9	100%	9	100%	9 a	100%	9	100%
37		4.1.2 Assess the risk of disease	9	100%	9	94.7%	9 0	100%	9	100%
38		4.1.3 Intervention on the risk of disease	9	100%	9	100%	9 og	100%	9	100%
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1 2 3 4 5 6 7	4.2 Screening 4.2.1 Early screening 4.2.2 Early diagnosis	9 9	100% 100%	9 9	100% 100%	-2023-082736 on 4 M rright, including for u 9 9	100% 100%	9 9	94.7% 94.7%
8	Note: Indicators in the table are modified versions after two re	ounds of c	onsultation; exp	perts rated t	he importance a	and feagibility	of each indic	ator on a 1-	-9 Likert
9	scale (1 = not important/feasible and 9 = very important/feasible	ble).				n 20: rela			
10	▲ items added in the second round					125. [
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Supplementary material 4. Final indicators in professional competency framework for general practitioners in tertiary hospitals in China

Primary indicator	Secondary indicators	Tertiary indicators
	1.1 Clinical knowledge	1.1.1 Possess comprehensive expertise in clinical
	and skills	medicine
		1.1.2 Possess comprehensive expertise in general
		practice
		1.1.3 History taking
		1.1.4 Physical examination
		1.1.5 Clinical test
		1.1.6 Basic clinical operation skill
		1.1.7 Diagnosis and differential diagnosis
		1.1.8 Medical record writing
	1.2 Diagnosis and	1.2.1 Manage diseases at early stage presenting in at
	treatment Services	undifferentiated way
		1.2.2 Treat outpatient and inpatient
		1.2.3 Manage emergency conditions
		1.2.4 Safe and rational use of medicines
		1.2.5 Arrange referrals to specialists or primary care
		when necessary
	1.3 Chronic disease	1.3.1 Help patients set chronic disease managemen
	management	goals
. Medical services	g	1.3.2 Health education
		1.3.3 Medication guidance
		1.3.4 Regular follow-up
		1.3.5 Help patients improve chronic disease
		management strategies
		1.3.6 Direct community-based chronic disease
		management
	1.4 Communication	°
	and Cooperation	1.4.1 Listen carefully to patients and be empathic
	I	1.4.2 Explain things clearly and check for patient
		and families understanding
		1.4.3 Discuss with patients and families about thei
		health condition and thoughts
		1.4.4 Propose treatment plan to patients and familie
		1.4.5 Engage patients and families in making
		decision of therapy plan that reflect their needs
		value and goals
		1 4 6 Communicate effectively with colleagues
		1. 1.0 Communicate chieven of the concagaes
		1.4.7 Communicate effectively with stuffs in primary
		1.4.7 Communicate effectively with stuffs in primary care institutions
2. Teaching	2.1 Theoretical	 1.4.7 Communicate effectively with stuffs in primary care institutions 2.1.1 Preparation and design for lectures

		2.1.2 know about teaching techniques
		2.1.3 Conduct theoretical lectures
	2.2 Practical teaching	2.2.1 Provide instruction to trainees in clinical
	8	2.2.2 Provide instruction to trainees in me
		records writing
		222 Provide instruction to traincos in di
		2.2.3 Provide instruction to trainees in di
		diagnosis and treatment
		2.2.4 Provide instruction to trainees in
		discussion
		2.2.5 Conduct joint theoretical lectures with pr
		care
		2.2.6 Conduct joint case discussion with pr
		care
		2.2.7 Conduct joint teaching rounds with pr
		care
	2 3 Salf-directed	2.3.1 Practice-based learning and improvemen
		2.5.1 Tractice-based learning and improvement
	learning	
		2.3.2 Continuing medical education
		2.3.3 Participate in academic activities actively
3. Research	3.1 Project design and	3.1.1 Literature search
	declaration	
		3.1.2 Literature reading
		3.1.3 know about the principles of research
		3.1.4 Write project application form
	3.2 Scientific research	3.2.1 Master investigation techniques
		3.2.2 Master scientific research methods
		2.2.2 Corru out agiantifia rassarah
		2.2.1 Statistic land in Statis
	3.3 Report scientific	3.3.1 Statistical analysis of data
	research results	
		3.3.2 Write paper
		3.3.3 Scientific research achievements
4. Prevention	4.1 Disease prevention	4.1.1 Know about the risk of disease
		4.1.2 Assess the risk of disease
		4.1.3 Intervention on the risk of disease
	4.2 Screening	4.2.1 Early screening
	5	