An Exploration of Medical Education in Central and Southern China: Measuring the Professional Competence of Clinical Undergraduates

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Abstract: Background: The cultivation and assessment of the professional competence of clinical undergraduates is essential to medical education. This study aimed to construct a scale to evaluate the professional competence of clinical undergraduates as well as its determinants. Methods: The competence scale was developed on the basis of four medical education standards, the literature, and expert interviews. A total of 288 undergraduates from two types of medical colleges in central and southeastern China were selected by a multistage sampling strategy. Factor analysis, correlation analysis, and internal consistency reliability were used to verify the validity and reliability of the scale. Results: A scale consisting of eight factors with 51 items was determined for factor analysis. Cronbach’s α coefficients among the eight dimensions were over 0.800, with mean scores of 1.76, 1.38, 1.92, 1.54, 1.77, 1.25, 1.60, and 2.34. Clinical undergraduates with above average academic grades achieved a higher score in essential clinical knowledge (p < 0.05) and better professionalism was reported among females (p < 0.05). Conclusion: The competence scale showed excellent reliability and validity. Respondents in this study showed a moderate level of professional competence. This study could be a reference for medical educators and policy makers in order to improve medical education standards for clinical undergraduates in China and other countries with similar settings.

Keywords: future physician; medical education standard; professional competence; clinical undergraduate; China

1. Introduction

With the transition from a biological medical model to a biopsychosocial model, medical education, which traditionally focuses on essential learning in science and clinical training, has been changed to emphasize multi-dimensional competence and to meet the needs of the population [1–4]. The three widely accepted international medical education standards [5–7]—the Global Minimum Essential Requirements in Medical Education (GMER) in 2002, International Standards for Undergraduate Education in the World Federation of Medical Education (WFME standards) in 2001, and WHO Guidelines for Quality Assurance of Basic Medical Education in the Western Pacific Region (WHO Standards) in 2012 [8–10]—present this multi-dimensional perspective. In 2008, based on GMER, WFME standards, and WHO Standards, the Chinese standard Undergraduate Medical Education Standard—Clinical Medicine (trail) was implemented [11]. In 2016, the formal version was promulgated, including objectives relating to ideological, moral, and professional quality, professional knowledge, and professional skills for clinical undergraduates (Table 1) [12].
Table 1. Dimensions of four medical education standards.

| Dimension                                      | Global Minimum Essential Requirements in Medical Education (GMER) | International Standards for Undergraduate Education in the World Federation of Medical Education (WFME Standards) | WHO Standards | Chinese Standards                                      |
|------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------|
| Professional values, behavior and ethics       | Essential biomedical sciences                                    | General objectives                                                                                       | Objectives relating to ideological and moral and professional quality |
| Scientific foundation of medicine              | Behavior, social sciences and medical ethics                     | Objectives relating to knowledge                                                                         | Objectives relating to knowledge |
| Communication skills                            | Clinical sciences and skills                                     | Objectives relating to skills                                                                           | Objectives relating to skills    |
| Clinical skills                                |                                                                  |                                                                                                           | Objectives relating to professionalism |
| Population health and health systems;          |                                                                  |                                                                                                           |                           |
| Management of information;                     |                                                                  |                                                                                                           |                           |
| Critical thinking and research                 |                                                                  |                                                                                                           |                           |

Furthermore, there is literature to enrich the definition and framework of professional competence from this decade. David displayed three professionalism frameworks in medical education, from virtue-based professionalism to behavior-based professionalism to professional identity formation. The last framework is viewed as an adaptive, developmental process to socialize learners into thinking, feeling, and acting like a physician at an individual as well as a collective level [13]. It is less often mentioned that professional competence is multidimensional and can be cultivated to the range of judgement and skills physicians need to be exhibit in practice [14]. Emanuel proposed that, in response to the trends of medical care, medical education should emphasize training in psychology, behavioral economics, leadership and team management, process improvement, etc. [15]. Klemenc-Ketis believed that medical professional competence should address empathy and humanism, professional relationships and development, and responsibility [16]. In competency-based medical education proposed by Powell, a health professional should be able to integrate knowledge, skills, values, and attitude [17]. However, some frameworks were theoretical frameworks and although some frameworks were used to assess the competence of students, the effectiveness of the instruments used was not verified, and it is unclear whether the outcomes of empirical studies fit the theoretical frameworks.

Additionally, many scholars have assessed a certain dimension of the professional competence of students, such as the professionalism of medical students [18–20], communication skills [21,22], and medical ethics [23,24], instead of comprehensive competence. Furthermore, although some scholars have assessed the comprehensive competence of medical professionals such as physicians [25,26] and nurses [27], few studies focused on the comprehensive competence of medical undergraduates.

This study aimed to (1) construct a professional competence instrument for clinical undergraduates in China; (2) measure their professional competence; (3) explore the determinants that are associated with their competence; (4) make some suggestions for medical educators and policy makers to improve the professional competence of clinical undergraduates in China.
2. Methods and Materials

2.1. Participants and Settings

A multistage sampling strategy was used in this study. First, we selected two medical colleges purposively. College A and B are two typical medical colleges in China. College A is a crucial university, located in Wuhan, Hubei Province, in central China, and B is a non-crucial university in the city of Dongguan, Guangdong Province, in southern China. A crucial university in China refers to a university that with high education level and is support as an essential program by government. Second, a cluster sampling was used to choose clinical undergraduates. We selected 2–3 classes in each college to finish the questionnaire with the assistance of the lecturer. The investigators provided and collected the questionnaires. Also, they would explain any questions when students were confused about the questionnaire. Only five-year medical undergraduates in their last year were involved in this study. A total of 305 questionnaires were distributed and based on the validity of the questionnaires, 288 of them were included in this study. Respondents completed the questionnaire anonymously, and their competence was independent of the evaluation made by others.

In China, after passing a National College Entrance Examination administered by the Ministry of Education, students from high school can enroll as medical undergraduates. Usually, there are two kinds of medical education programs, the five-year and eight-year programs. Applicants to the eight-year program should have a higher score than those to five-year. These programs have different goals. Five-year medical students receive a bachelor’s degree when they graduate, and eight-year students receive a medical doctor’s degree. In general, it takes another three years of residency training program for five-year medical students to receive a master’s degree. Besides, they could choose to spend one year of residency training after graduation to join the Chinese Medical License Examination [28]. Thus, physicians from a five-year program account for a considerable proportion in general in China.

The respondents were investigated two months before graduation to make sure their answers to the instrument were reflect of their actual professional competence. A total of 288 medical undergraduates who majored in clinical medicine participated in this study—of which, 95 were from College A (33.0%) and 193 (67.0%) were from College B. In total, 159 (55.2%) were female and 129 (44.8%) were male. The instrument was a 4-point Likert scale (not at all/a little/most/entirely). The study protocol did not require ethical approval. The students’ information was anonymized and de-identified before the analysis.

2.2. Medical Competence Instrument

Based on these four standards in Table 1, we drafted a five-dimension professional competence scale, namely, dimensions of essential medical knowledge, public health and social sciences, clinical professional skills, critical thinking/adaptation, and professionalism.

However, the professional competence of medical students is enriched with the development of the medical model and disease spectrum. We added other items according to former studies, also we modified the instrument combined with the syllabus of both college A and B and previous studies (Appendix A Table A1). Table 2 shows the number of items from different resources in each dimension. Finally, a medical professional competence scale with 52 items in 5 dimensions was developed theoretically (Appendix A Table A2).

To improve the reliability and validity of the instrument, we asked experts’ suggestion to make sure the instrument could cover the most of clinical undergraduates’ professional competence. And finally a self-assessment instrument was made to evaluate the professional competence of students [13,29].
Table 2. Number of items from different resources in each dimension.

| Dimensions of the Scale in This Study | Total Number in Each Dimension | GMER Standards | WHO Standards | WFME Standards | Chinese Standards | Others |
|---------------------------------------|--------------------------------|----------------|---------------|----------------|-------------------|-------|
| Essential medical knowledge           | 4                              | 4              | 4             | 4              | 4                 | 0     |
| Public health and social science knowledge | 12                          | 3              | 2             | 3              | 11                | 1     |
| Clinical professional skills          | 17                             | 11             | 11            | 5              | 9                 | 2     |
| Critical thinking/adaptation          | 7                              | 3              | 1             | 1              | 3                 | 2     |
| professionalism                        | 12                             | 0              | 3             | 0              | 6                 | 3     |

3. Results

3.1. Factor Analysis for the Medical Professional Competence Scale

Factor analysis showed that the Kaiser-Meyer-Olkin (KMO) value of the scale is 0.939, and \( p < 0.01 \) in the spherical test, indicating that this scale was suitable for factor analysis. There were eight factors with a value over 1.00. One item was excluded because its factor loading was less than 0.4. Table 3 shows the status of the factor loads and variance contribution. Thus, the scale was shown to have eight dimensions with 51 items.

Table 3. Factor analysis of medical professional competence scale.

| Items | Factors |
|-------|---------|
|       | F1      | F2      | F3      | F4      | F5      | F6      | F7      | F8      |
| A1    | 0.365   | 0.163   | 0.241   | 0.199   | -0.005  | 0.121   | 0.435   | -0.010  |
| A2    | 0.280   | 0.208   | 0.190   | -0.006  | 0.321   | 0.135   | 0.666   | 0.049   |
| A3    | 0.217   | 0.160   | 0.204   | 0.008   | 0.377   | 0.095   | 0.690   | -0.014  |
| A4    | 0.398   | 0.125   | 0.109   | 0.107   | 0.093   | 0.192   | 0.600   | 0.115   |
| B5    | 0.554   | 0.146   | 0.107   | 0.365   | 0.002   | 0.204   | 0.395   | -0.059  |
| B6    | 0.612   | 0.063   | 0.189   | 0.327   | 0.084   | 0.223   | 0.301   | -0.012  |
| B7    | 0.699   | -0.018  | 0.163   | 0.192   | 0.016   | 0.160   | 0.274   | 0.136   |
| B8    | 0.700   | -0.062  | 0.090   | 0.053   | 0.113   | 0.097   | 0.118   | 0.173   |
| B9    | 0.738   | 0.069   | 0.106   | 0.089   | 0.169   | 0.094   | 0.062   | 0.080   |
| B10   | 0.642   | 0.247   | 0.110   | 0.186   | 0.199   | 0.014   | 0.101   | 0.061   |
| B11   | 0.764   | 0.009   | 0.117   | 0.155   | 0.113   | 0.094   | 0.039   | 0.110   |
| B12   | 0.736   | 0.074   | 0.111   | 0.096   | 0.083   | 0.103   | 0.147   | 0.102   |
| B13   | 0.802   | 0.041   | 0.140   | 0.122   | -0.011  | 0.113   | 0.084   | 0.075   |
| B14   | 0.805   | -0.004  | 0.168   | 0.099   | 0.073   | 0.143   | -0.012  | 0.117   |
| B15   | 0.717   | 0.119   | 0.289   | -0.049  | 0.057   | 0.136   | 0.085   | 0.050   |
| B16   | 0.667   | 0.073   | 0.274   | -0.016  | 0.185   | 0.100   | 0.177   | 0.112   |
| C17   | 0.196   | 0.205   | 0.275   | 0.310   | 0.664   | 0.086   | 0.185   | -0.012  |
| C18   | 0.182   | 0.278   | 0.154   | 0.165   | 0.769   | 0.075   | 0.092   | -0.012  |
| C19   | 0.191   | 0.121   | 0.130   | 0.150   | 0.752   | 0.183   | 0.201   | 0.079   |
| C20   | 0.312   | 0.096   | 0.173   | 0.183   | 0.222   | 0.554   | 0.268   | 0.140   |
| C22   | 0.298   | 0.083   | 0.192   | 0.273   | 0.354   | 0.401   | 0.219   | 0.234   |
| C23   | 0.355   | 0.034   | 0.229   | 0.383   | 0.122   | 0.541   | 0.125   | 0.104   |
| C24   | 0.324   | 0.086   | 0.121   | 0.215   | 0.244   | 0.552   | 0.186   | 0.143   |
| C25   | 0.286   | 0.105   | 0.259   | 0.305   | 0.162   | 0.551   | 0.207   | -0.019  |
| C30   | 0.304   | -0.009  | 0.264   | 0.151   | -0.043  | 0.536   | -0.026  | 0.292   |
| C26   | 0.200   | 0.153   | 0.223   | 0.579   | 0.302   | 0.343   | 0.060   | 0.007   |
| C27   | 0.216   | 0.264   | 0.220   | 0.585   | 0.331   | 0.092   | 0.014   | -0.030  |
From Table 3, A to E in the first column showed the original construction of the instrument. The results of the factor analysis showed that the items in the dimensions of essential medical knowledge, public health and social science knowledge, critical thinking/adaptation, and professionalism were entirely consistent with the theoretical assumption. However, items in the dimension of clinical professional skill, which had been in one dimension, were divided into four dimensions. We renamed them as essential clinical skills (to understand medical history, to write medical cases correctly and other primary clinical skills), advanced clinical skills (more professional medical skills, such as the ability to adequately diagnose the patient, first aid and associated skills), communication skills (the ability to communicate well with the patient, relatives, colleagues, community and society) and advanced study skills (such as the ability to research, information retrieval skills and medical English).

3.2. Correlation Analysis and Internal Consistency Reliability of the Scale

In Table 4, among all the correlation coefficients of the eight dimensions, three of them were over 0.741, seven were between 0.684 and 0.611, eleven were between 0.435 and 0.596, and the rest were less than 0.362. Notably, professionalism (Factor 8) is weakly correlated with the other dimensions (0.161–0.371). Moreover, the internal consistency coefficients of each dimension were all over 0.800.
Table 4. Correlation analysis and the internal consistency reliability of the scale.

| Dimensions | F1  | F2  | F3  | F4  | F5  | F6  | F7  | F8  | Total | Cronbach's α | X ± S   |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-------|--------------|--------|
| F1         | 1   |     |     |     |     |     |     |     |       | 0.800        | 1.76 ± 0.54 |
| F2         | 0.636 * | 1   |     |     |     |     |     |     |       | 0.939        | 1.38 ± 0.61 |
| F3         | 0.534 * | 0.449 * | 1   |     |     |     |     |     |       | 0.852        | 1.92 ± 0.51 |
| F4         | 0.572 * | 0.684 * | 0.542 * | 1   |     |     |     |     |       | 0.852        | 1.54 ± 0.64 |
| F5         | 0.498 * | 0.533 * | 0.572 * | 0.665 * | 1   |     |     |     |       | 0.842        | 1.77 ± 0.59 |
| F6         | 0.435 * | 0.643 * | 0.272 * | 0.630 * | 0.466 * | 1   |     |     |       | 0.833        | 1.25 ± 0.70 |
| F7         | 0.538 * | 0.611 * | 0.501 * | 0.652 * | 0.581 * | 0.595 * | 1   |     |       | 0.899        | 1.60 ± 0.65 |
| F8         | 0.362 * | 0.214 * | 0.373 * | 0.237 * | 0.345 * | 0.161 * | 0.338 * | 1   |       | 0.952        | 2.34 ± 0.57 |
| Total      | 0.741 * | 0.827 * | 0.663 * | 0.809 * | 0.744 * | 0.681 * | 0.809 * | 0.596 * | 1       | 0.962        | 1.70 ± 0.60 |

Note: * p < 0.05; F1—essential medical knowledge; F2—public health and social science; F3—essential clinical skill; F4—advanced clinical skill; F5—communication skill; F6—advanced study skill; F7—critical thinking/adaptation; F8—professionalism. X mean score; S Standard deviation.
3.3. Medical Professional Competence of Clinical Undergraduates and Its Determinants

As Table 4, the mean scores of the dimensions of essential medical knowledge, essential clinical skills, communication skills, and professionalism was 1.76, 1.92, and 1.77, and are all higher than the total mean score. Excluding the mean score of professionalism, which was over 2.00, the mean score of all the other dimensions was between 1.25 and 1.60. Dimensions of public health and social science and advanced study skill had mean scores of 1.38 and 1.25.

Table 5 indicates that clinical undergraduates with self-rated above average academic grades had higher professional competence scores on the dimension of essential medical knowledge than those with a score that is below average ($t = 2.406, p = 0.017$). Respondents in College A reported better critical thinking/adaptation ($t = 2.611, p = 0.010$). The scores for the professionalism of female clinical undergraduate were higher than for males ($t = 3.147, p = 0.002$), and undergraduates in College A seemed to have greater professionalism than those in College B ($t = 2.696, p = 0.007$). However, there is no significant difference between the categories of each determinant in the other dimensions of the professional competence scale ($p > 0.05$).

| Dimensions                      | Determinants         | $n$ | Scores ($X \pm S$) | $t$   | $p$  |
|---------------------------------|----------------------|-----|-------------------|-------|------|
| Essential medical knowledge     | Academic grade       | 153 | 6.82 ± 1.717      | 2.406 | 0.017|
|                                 | Below average        | 135 | 7.30 ± 1.658      |       |      |
| Critical thinking/adaptation    | College              | 95  | 4.147 ± 1.930     | 2.611 | 0.010|
|                                 | College A            | 95  | 4.147 ± 1.930     |       |      |
|                                 | College B            | 193 | 3.568 ± 1.689     |       |      |
| Professionalism                 | Gender               | 129 | 27.02 ± 5.782     | 3.147 | 0.002|
|                                 | Male                 | 129 | 27.02 ± 5.782     |       |      |
|                                 | Female               | 159 | 29.05 ± 5.140     |       |      |
|                                 | College              | 95  | 29.38 ± 5.728     | 2.696 | 0.007|
|                                 | College A            | 95  | 29.38 ± 5.728     |       |      |
|                                 | College B            | 193 | 27.53 ± 5.325     |       |      |

4. Discussion

This study developed an instrument to evaluate the professional competence of clinical undergraduates in two medical colleges in central and southern China. The results of the factor analysis, correlation analysis, and internal consistency analysis showed instruments with excellent reliability and validity. Moreover, we also evaluated the professional competence of the respondents and analyzed the associated factors and their competence. The findings of this study provide some insights into the competence of medical students for medical educators and policy makers.

First, the professional competence scale in this study showed excellent reliability and validity. As for the eight dimensions of the scale, four of them were consistent with the theoretical assumption. The dimensions of clinical professional skills were considered as an independent dimension theoretically in this study, as well as in the medical education standards (GMER, WFME standards, and WHO standards), but factor analysis indicated that it could be divided into four independent dimensions instead of one. It could be seen in the six core competences for physicians proposed by ACGME, and dimensions such as communication skills, practice-based learning and improvement, which were considered in the dimension of clinical professional skills in this study, were also constructed as independent parts of professional competence [30]. Therefore, medical education educators should cultivate the multi-dimensional competence of students, and policy makers should improve medical standards continuously in order to meet new challenges in the field of health and medicine.

Second, the correlation analysis suggested that professionalism is weakly related to other dimensions. In general, staff with a high level of professional knowledge and skills but weak professionalism could result in severe consequences in the field of medicine and health, as well as in other professions, such as lawyers [31] and teachers [32]. In fact, professionalism is considered an important facet when recruiting medical students in some countries. In America, medical-related
social and community activities in the undergraduate period are considered as a reference when the medical colleges recruit students [33]. Since professionalism is relatively independent to other dimensions, it should be considered not only in the undergraduate period but from admission [34,35], as well as in the education period [36], internship period [37,38], and at the workplace [39].

Third, according to the results in Table 5, undergraduates with above average academic grades reported better essential professional knowledge scores, indicating that academic grade could only be a reflection of their professional knowledge, but it could not reflect other facets of professional competence. A scholar even suggested less preclinical training in basic sciences in response to the trend of the increase in medical information and patient data [15]. Education for clinical undergraduates should be transformed from just emphasis on knowledge and professional skill to the cultivation of comprehensive competence. Moreover, students in College A achieved higher scores in the dimensions of critical thinking/adaptation and professionalism than those in College B, which might be due to the college context, education resources, or the learning climate [40]. As for gender differences, we found that higher scores in the dimension of professionalism were reported for females than for males, which was consistent with previous studies. Investigators revealed that women possessed more compassion in their work than men [41], and female doctors were more sympathetic than male doctors [42]. Females should be treated as equally to males when college and medical institutions recruit. Thus, improving the comprehensive professional competence of medical students could be a meaningful means to improving the effectiveness of the health care system [43].

There were some limitations in this study. First, although College A and B were purposively selected, they did not represent all the medical colleges in China, and thus further studies should be conducted in more colleges. Second, a self-rated instrument was used to evaluate the medical professional competence of undergraduates, and it might not be consistent with their objective competence entirely. Finally, several potential factors, such as the college atmosphere and the education process were not addressed.

5. Conclusions

A medical professional competence instrument was developed in this study to the evaluate professional competence of clinical undergraduates in central and southern China. According to the results of the factor analysis, the correlation analysis, and the internal consistency reliability, this instrument has excellent reliability and validity. The professional competence scale consisted of eight dimensions with a total of 51 items. These dimensions were essential medical knowledge, public health or social science, essential clinical skills, advanced clinical skills, communication skills, advanced study skills, critical thinking and adaptation, and professionalism. Respondents in this study showed a moderate level of professional competence. Their public health/social sciences knowledge, advanced clinical skills, and critical thinking/adaptation still need to be improved. Undergraduates with an above average academic grade achieved higher scores in the dimension of essential medical knowledge than those with a below average academic grade. Undergraduates in College A achieved a higher score in the dimension of critical thinking/adaptation and professionalism than those in College B. Moreover, better professionalism was reported among females. This study could be a reference for medical educators and policy makers in order to improve medical education standards for clinical undergraduates in China and other countries with similar settings.

Author Contributions: J.C. and X.C. were responsible for the conception and design of the study. X.C. performed the research. Both of the authors analyzed the data, participated in interpretation of the findings, and drafted the manuscript. X.C. and J.C. confirm that the content has not been published elsewhere and does not overlap or duplicate their published work.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Supplementary items and their sources.

| Item | Contents                                                      | Sources                                                                 |
|------|---------------------------------------------------------------|------------------------------------------------------------------------|
| 16   | Know the country’s policy and development trends in this field.| Yan Zhao, Yunfeng Wang, et al. A comparative study of eight-year students’ professional qualities. China Higher Medical Education, 2017(5): 1–3. |
| 23   | Know the principle of the rational clinical use of blood.     | Objectives relating to clinical skill in College A.                     |
| 25   | The ability to help trainees/interns with clinical teaching.  | Objectives relating to clinical skill in College A.                     |
| 38   | Be able to make reasonable arrangements for practice, activities, and resources. | Ying Li. Study on Developmental Evaluation System of Humanistic Quality of Medical Students. Third Military Medical University, 2011. |
| 40   | Keep a strong physique and abundant spirit.                   | Jahan F, Siddiqui M A, Al Zadjali N M, et al. Recognition of Core Elements of Medical Professionalism among Medical Students and Faculty Members. Oman Med. J. 2016, 31(3): 196–204. |
| 50   | Be able to be friendly and kind to patients and colleagues.  | Bernard, A.W.; Matthew, M.; Kman, N.E.; et al. Medical Student Professionalism Narratives: A Thematic Analysis and Interdisciplinary Comparative Investigation. BMC Emergency Medicine, 2011, 11(1): 1–8. |
| 51   | Keep clean, neat, and polite.                                | Jahan, F.; Siddiqui, M.A.; Al Zadjali, N.M.; et al. Recognition of Core Elements of Medical Professionalism among Medical Students and Faculty Members. Oman Med. J. 2016, 31(3): 196–204. |
| 52   | Willing to make efforts in medicine development.             | Objectives relating to clinical skill in A university.                  |

Table A2. Original instrument for clinical undergraduate.

| Items                                                                 | Not at All | A little | Most | Fully |
|-----------------------------------------------------------------------|------------|----------|------|-------|
| A1. Knowledge of natural science                                       |            |          |      |       |
| A2. Knowledge of essential biomedical theories (human anatomy; organization and embryology; biochemistry and molecular biology; physiology, etc.) |            |          |      |       |
| A3. Essential knowledge of clinical medicine (internal medicine, surgery, gynecology, pediatrics, etc.) |            |          |      |       |
| A4. Knowledge of essential pharmacological theories and clinical rational drug elements |            |          |      |       |
| B5. Knowledge the essential theories of infectious diseases and epidemics |            |          |      |       |
| B6. Knowledge of the emergency treatments of public health practices and preventive medicine knowledge |            |          |      |       |
| B7. Other public health theories (environmental hygiene; child hygiene; maternal and child health care; health education, etc.) |            |          |      |       |
| B8. Know health-related laws, regulations and standards, etc.          |            |          |      |       |
| B9. Know essential principles of medical psychology                    |            |          |      |       |
| B10. Knowledge of medical ethics                                       |            |          |      |       |
| B11. Know the principles and methods of evidence-based medicine        |            |          |      |       |
| B12. Comprehend essential health statistics methods                     |            |          |      |       |
| Items                                                                 | Not at All | A little | Most | Fully |
|----------------------------------------------------------------------|------------|----------|------|-------|
| B13. Comprehend essential theories of health economics                |            |          |      |       |
| B14. Comprehend the basic principles of health management            |            |          |      |       |
| B15. Know the history of medical development                         |            |          |      |       |
| B16. Know the country’s policy and development trends in the field   |            |          |      |       |
| C17. The ability to collect medical history flexibly and accurately   |            |          |      |       |
| C18. The ability to write cases correctly                            |            |          |      |       |
| C19. The ability to perform physical examinations accurately         |            |          |      |       |
| C20. The ability to perform mental examinations accurately            |            |          |      |       |
| C21. The ability to distinguish the severity of the disease in time, and master general first-aid skills |            |          |      |       |
| C22. The ability to choose the most suitable and economical diagnostic program |            |          |      |       |
| C23. Know the principles of the rational clinical use of blood       |            |          |      |       |
| C24. The ability to use essential drugs                              |            |          |      |       |
| C25. The ability to help trainees/interns with clinical teaching     |            |          |      |       |
| C26. Be able to communicate with patients and relatives clearly, thoughtfully, and carefully |            |          |      |       |
| C27. Be able to be harmonious into the team                           |            |          |      |       |
| C28. The ability to communicate with community residents, other departments and the public media effectively |            |          |      |       |
| C29. The ability to provide advice and accurate information to patients and their families rigorously |            |          |      |       |
| C30. The ability to perform clinical research                         |            |          |      |       |
| C31. Possess essential medical information retrieval capabilities    |            |          |      |       |
| C32. Proficient in medical English                                  |            |          |      |       |
| C33. The ability to obtain a proper diagnosis                         |            |          |      |       |
| D34. The ability to apply new technology and methods to the medical field |            |          |      |       |
| D35. Possess innovative thinking                                     |            |          |      |       |
| D36. Be good at observing things as well as putting forward your own point of view |            |          |      |       |
| D37. Able to consciously think and make a rational judgment after analyzing a problem independently |            |          |      |       |
| D38. The ability to make reasonable arrangements for practice, activities, and resources |            |          |      |       |
| D39. Desire for lifelong learning                                    |            |          |      |       |
| D40. Maintain a strong physique and abundant spirit                  |            |          |      |       |
| E41. Have a passion for your profession                              |            |          |      |       |
| E42. Adhere to a concept of patient-centered service                 |            |          |      |       |
| E43. Know about professional ethics                                  |            |          |      |       |
| E44. Honesty and justice                                            |            |          |      |       |
| E45. Have no discrimination with regard to a patient’s gender, race, age and other differences |            |          |      |       |
Table A2. Cont.

| Items                                                                 | Not at All | A little | Most | Fully |
|----------------------------------------------------------------------|------------|----------|------|-------|
| E46. Willing to protect the legitimate rights of patients (personal   |            |          |      |       |
|    safety, right to know, consent, privacy, etc.) and economic interests |            |          |      |       |
| E47. Able to realize your deficiency. When the medical activities     |            |          |      |       |
|    you have to deal with beyond your ability, take the initiative to  |            |          |      |       |
|    seek the help of other doctors                                      |            |          |      |       |
| E48. Desire to relieve the patient’s pain sincerely                    |            |          |      |       |
| E49. Remain sincere and honest to patients, family members,           |            |          |      |       |
|    colleagues, and so on                                              |            |          |      |       |
| E50. Friendly and kind to patients and colleagues                     |            |          |      |       |
| E51. Always keep clean, neat, and polite                              |            |          |      |       |
| E52. Willing to make efforts to medicine development                  |            |          |      |       |

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