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Development of an evaluation index system for the humanistic qualities of medical practitioners in China.

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Abstract

Background: A comprehensive evaluation model for the assessment of the humanistic qualities of medical practitioners is not currently available in Mainland China; thus, we aimed to construct one using the Analytic Hierarchy Process (AHP) method.
Methods: We determined the weight of 37 indicators of the humanistic evaluation system.
Results: We found that the consistency ratio index provided by each expert upon grading was less than 0.1. Among all the indicators in the scheme layer, "reverence for life" had the highest weight (0.066), whereas "bioethics" and "ability to express empathy" were 0.053 and 0.047, respectively. The results of the AHP model were better than the results of the mean method model.
Conclusion: The model of evaluation that was established based on AHP is an objective and effective system and also represents a suitable guide for the selection and evaluation of personnel.

Keywords: Analytic hierarchy process, Medical practitioners, Medical humanistic qualities, Evaluation index system.

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Introduction

Medical humanistic qualities are characteristically based on common human qualities expressed in the medical field. These qualities are an essential requirement for medical professionals and are critical to the medical field. It is well accepted that, for a medical practitioner, medical humanistic qualities are as equally important as medical skills.

With the rapid development of new and improved medical technologies, dramatic changes have occurred in doctor-patient relationships since the 1960s and 1970s [1]. In recent years, increasingly frequent incidents of doctor-patient conflicts and disturbances indicate that the basic doctor-patient relationship is becoming tense, at least in Mainland China. In 2006, the Chinese Medical Doctor Association conducted a questionnaire-based survey in 350 hospitals in China. The data revealed that the occurrence of medical disturbances increased from 89.58% in 2004 to 97.92% in 2006. During this period, the number of medical professionals injured increased from 203 times per year to 332 times per year, with a direct economic loss that increased from RMB 9.87 million to RMB 14.48 million (Rights Protection Committee of Chinese Medical Doctor Association, 2007) [2]. This survey also revealed that many patients do not trust hospitals and doctors, which results in lower patient satisfaction. Therefore, the importance of medical humanistic qualities in clinical practice has widely been acknowledged by the society.

In the United States, the humanistic qualities of clinical physicians have traditionally been evaluated from a patient's perspective during routine clinical encounters. In this way, the objective is to assess the effects of a clinician's emotional content and communication skills on treatment outcomes rather than to evaluate the clinician comprehensively. For example, Carol assessed the effects of doctor-patient communication during clinical encounters on the progression of disease by correlating the physician-patient interaction with blood pressure control. The results suggested that effective communication and an emotional connection positively affected treatment outcomes [3]. Timothy evaluated both clinical physicians' ability to communicate with patients and their humanistic qualities with the assistance of three trained observers, each of whom rated 20 videotaped clinical encounters [4]. The evaluation methodology employed in this study also relied on the paradigm of personalization and intuitive direction. In an even worse situation, the evaluation of humanistic qualities of physicians in Mainland China has not been adequately studied. Therefore, a comprehensive evaluation system based on scientific methods is needed to be developed for the Chinese context.

Exploring the construction of the Humanistic Quality Evaluation System (HQES) for medical practitioners and identifying its basic elements are particularly important for the development and evaluation of the humanistic qualities among medical practitioners. The HQES is a multilevel and complex data system that comprises numerous factors that are mutually associated and controlled. The HQES not only requires an in-depth analysis of the hierarchy evaluation of each expert but also combines the advice of every expert to make a final decision. Therefore, the Analytic Hierarchy Process (AHP), which is used in this study, is an effective method to meet these requirements [5,6].

Materials and Methods

We used the AHP method that was slightly modified based on the previous studies [7,8]. The data in this study were collected from 31 provinces over the entire Mainland China, including Beijing, Tianjin, Hebei, Henan, Shan'xi, Shandong, Liaoning, He Longjiang, Nei Menggu, Shanghai, Zhejiang, Jiangsu, Anhui, Guangxi, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Hainan, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shan'xi, Gansu, Xinjiang and Qinghai. The data collection period was from January of 2014 to December of 2015. We declare no conflict of interests in this study.

Establishment of the evaluation index system

A four-layer HQES (Figure 1) was established by adopting multiple research methods, e.g., literature studies, a historical review, expert interviews, and survey questionnaires (Table 1).

Layer one is the Target Layer (O). This layer consists of quantitative rankings of the evaluation indexes of the humanistic qualities of medical practitioners.

Layer two is Criterion Layer I (A). This layer is the primary evaluation index factors of the HQES, which includes medical humanistic knowledge, medical humanistic ability and medical humanistic spirit-marked as A1, A2 and A3, respectively, in sequence.

Layer three is Criterion Layer II (B). This layer consists of 11 evaluation index factors included in the three primary evaluation index factors and are marked as B_i (*i=1, 2, .., 11*) in sequence.

Layer four is the Project Layer (C). This layer consists of 37 evaluation index factors derived from Criterion Layer II (B) and marked as C_j (*j=1, 2, .., 37*) in sequence.

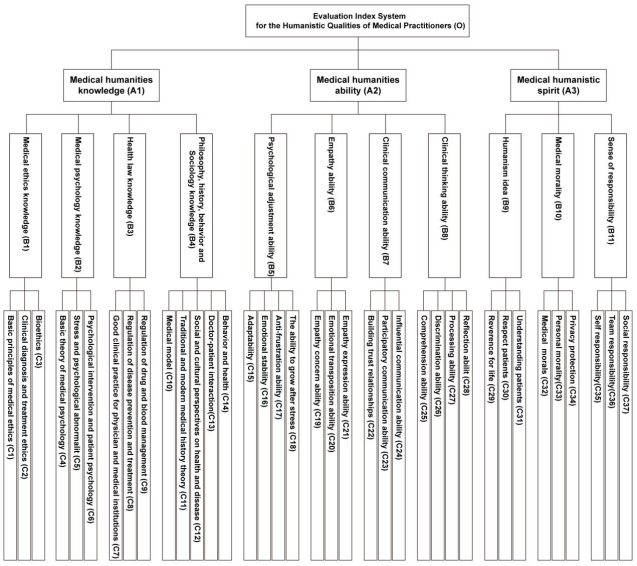

Figure 1. *Summary graph for the four-layer humanistic quality evaluation system. This system includes target layer (O), criterion layer I (A1, A2, A3), criterion layer II (B1 to B11) and project layer (C1 to C37).*

Table 1. *Project layer weight and comprehensive weight of each expert.*

	Expert I	Expert II	Expert III	Expert IV	Expert V	Expert VI	Expert VII	Expert VIII	Expert IX	Expert X	Comprehensive weight	Weight order
C1	0.021	0.05	0.073	0.09	0.014	0.044	0.039	0.037	0.043	0.053	0.044	4
C2	0.014	0.013	0.073	0.045	0.042	0.022	0.039	0.03	0.008	0.042	0.027	15
C3	0.034	0.153	0.146	0.045	0.042	0.022	0.039	0.024	0.023	0.033	0.053	2
C4	0.024	0.035	0.036	0.045	0.049	0.053	0.007	0.005	0.014	0.009	0.018	26
C5	0.01	0.004	0.036	0.022	0.025	0.018	0.014	0.008	0.076	0.016	0.025	20
C6	0.015	0.035	0.073	0.022	0.025	0.018	0.014	0.015	0.072	0.03	0.034	11
C7	0.011	0.023	0.087	0.027	0.01	0.032	0.017	0.013	0.016	0.048	0.025	19
C8	0.017	0.004	0.029	0.014	0.017	0.008	0.017	0.013	0.016	0.048	0.018	25
C9	0.007	0.002	0.029	0.014	0.004	0.008	0.017	0.013	0.016	0.048	0.016	28
C10	0.025	0.004	0.007	0.015	0.019	0.005	0.005	0.004	0.029	0.007	0.013	35
C11	0.01	0	0.012	0.015	0.006	0.004	0.007	0.004	0.008	0.007	0.007	37

C12	0.025	0.001	0.018	0.015	0.024	0.006	0.012	0.005	0.024	0.011	0.014	34
C13	0.013	0.003	0.018	0.015	0.024	0.007	0.015	0.012	0.026	0.024	0.016	30
C14	0.025	0.005	0.018	0.015	0.032	0.005	0.009	0.012	0.018	0.024	0.016	29
C15	0.027	0.074	0.011	0.032	0.025	0.039	0.005	0.024	0.005	0.028	0.025	18
C16	0.019	0.014	0.006	0.016	0.025	0.021	0.012	0.012	0.003	0.014	0.012	36
C17	0.038	0.015	0.011	0.016	0.025	0.015	0.02	0.017	0.006	0.02	0.018	27
C18	0.013	0.004	0.011	0.016	0.025	0.016	0.034	0.017	0.007	0.02	0.014	33
C19	0.028	0.018	0.048	0.027	0.014	0.023	0.039	0.061	0.02	0.036	0.036	9
C20	0.018	0.071	0.048	0.027	0.043	0.011	0.097	0.038	0.02	0.023	0.038	6
C21	0.023	0.014	0.048	0.027	0.043	0.011	0.061	0.096	0.02	0.057	0.047	3
C22	0.061	0.015	0.022	0.04	0.033	0.061	0.057	0.038	0.028	0.045	0.038	7
C23	0.038	0.003	0.014	0.02	0.033	0.061	0.023	0.038	0.014	0.045	0.027	16
C24	0.096	0.001	0.009	0.02	0.033	0.061	0.036	0.038	0.014	0.045	0.036	8
C25	0.019	0.04	0.004	0.04	0.007	0.036	0.016	0.055	0.013	0.033	0.029	14
C26	0.033	0.01	0.002	0.04	0.012	0.031	0.045	0.033	0.006	0.02	0.022	23
C27	0.039	0.049	0.005	0.04	0.004	0.043	0.032	0.019	0.009	0.011	0.024	22
C28	0.047	0.004	0.01	0.04	0.01	0.072	0.023	0.007	0.005	0.004	0.015	32
C29	0.024	0.117	0.023	0.022	0.049	0.063	0.071	0.016	0.189	0.01	0.066	1
C30	0.012	0.013	0.003	0.022	0.049	0.031	0.018	0.02	0.063	0.013	0.024	21
C31	0.012	0.013	0.003	0.022	0.049	0.031	0.011	0.026	0.063	0.017	0.025	17
C32	0.038	0.101	0.011	0.027	0.089	0.018	0.02	0.031	0.025	0.02	0.036	10
C33	0.024	0.009	0.017	0.027	0.03	0.036	0.031	0.031	0.056	0.02	0.03	13
C34	0.061	0.033	0.027	0.013	0.03	0.009	0.049	0.062	0.022	0.04	0.043	5
C35	0.031	0.004	0.006	0.022	0.004	0.02	0.01	0.024	0.004	0.016	0.016	31
C36	0.016	0.006	0.002	0.022	0.016	0.016	0.016	0.039	0.008	0.025	0.019	24
C37	0.031	0.038	0.003	0.022	0.016	0.026	0.025	0.061	0.015	0.039	0.034	12

Construction of the judgment matrix

The judgment matrix was constructed by comparing the influence of all the factors on the same layer with the corresponding factors of the upper layer. This means that each factor at the same layer was respectively compared with the corresponding factors (at the upper layer) in pairs according to the evaluation indexes of the HQES.

To compare the influence of the n factors (Y_1, Y_2, ..., Y_n) on X (at the upper layer), the proportion of the n factors in X was determined. d_{ij} was used to describe the influence ratio of any two factors (for example, Y_i and Y_j) to X, and the proportion scale of d_{ij} ($I, j=1, 2, ..., n$) was marked from 1-9. After this procedure, the judgment matrix $D=(d_{ij})_{n \times n}$ was obtained for pair comparisons.

For this example, the formula would obviously be

$D_{ij}>0$, $d_{ji}=i/d_{ij}$, $d_{ii}=1$ ($I, j=1, 2, .., n$) → (1)

Confirmation and consistency check of weight

The formula for the general judgment matrix D_{was} DW=λ_{max} W in which λ_{max} was the maximum characteristic root of D, and W was the corresponding eigenvector of λ_{max}. W can be approximately taken as a weight vector of D after normalization.

A consistency check was an important approach to evaluate the reasonableness of the judgment matrix. The evaluation method was as follows:

$CR=CI/RI$ → (2)

In this formula, CI=λ_{max}-n/n-1, RI was a random consistency index, and the matrices with different orders corresponded to different values. In the case of CR<0.10, the consistency of the matrix was acceptable.

Determination of the weight vector $_W^A$ of Criterion Layer I (A) to the Target Layer (O)

Judgment matrix $D_0=(d_{ij})_{3\times 3}$ was constructed according to the principle of constructing judgment matrices, and D_0 was the straight reciprocal matrix of Order 3. The value of λ_{max} and its corresponding eigenvector were solved, along with normalization for this eigenvector. After this process, the weight W_A of Criterion Layer (A) to the Target Layer (O) was obtained.

$W^A=(w_1^a, w_2^a, w_3^a)\ T \rightarrow (3)$

After obtaining the value W^A of ten experts with Equation 3, the consistency ratio was calculated with Equation 2. As a result, the CR^A of all experts was less than 0.1, which suggests that W_A can be used as a weight vector because this constructed judgment matrix satisfies the consistency requirements.

Determination of the combination weight of criterion layer II (B) to the target layer (O)

Judgment matrices $D_1=(d_{ij})_{4\times 4}$, $D_2=d_{ij})_{4\times 4}$ and $D_3=d_{ij})_{3\times 3}$ were constructed by following the principle of constructing judgment matrices and by corresponding to the factor indexes of criterion layer IA. The weights $P_1^B=(P_{11}^b, P_{12}^b, P_{13}^b, P_{14}^b)\ T$, $P_2^B=(P_{21}^b, P_{22}^b, P_{23}^b, P_{24}^b)\ T$ and $P_3^B=(P_{31}^b, P_{32}^b, P_{33}^b, P_{34}^b)\ T$ of criterion layer II to criterion layer I were then calculated. The combination weight W^B of criterion layer II to the target layer IA was

$WB=(w_1^aP_1^B,\ w_2^aP_2^B,\ w_3^aP_3^B)=(w^b_{11},\ w^b_{12},\ w^b_{13},\ w^b_{14},\ w^b_{21},\ w^b_{22},\ w^b_{23},\ w^b_{31},\ w^b_{32},\ w^b_{33}) \rightarrow (4)$

Because $CI^{(B)}=CI^{(B)}\ W^o$ and $RI^{(B)}=RI^{(B)}\ W^o$ can be obtained from the above formula, the index of the combined consistency ratio was

$CR^B=CR^A+CI^{(B)}/RI^{(B)} \rightarrow (5)$

The calculated CR^B values of all experts were less than 0.1, which complies with the consistency requirement in constructing the judgment matrix. Therefore, W_B can be applied as the weight vector of criterion layer II.

Determination of the combination weight W^C of the project layer to the target layer

Judgment matrix D_{ci} ($i=1, 2,..., 11$) was constructed based on the principle of constructing judgment matrices. Each judgment matrix corresponds to the factor index of criterion layer II. The combination weight vector W^C of the project layer to the target layer was obtained after calculating the combination weight with the judgment matrix

$W^C=(w_k)_{37\times 1}=(w^b_{ij}\ S_{ijk})_{37\times 1} \rightarrow (6)$

In this formula, S_{ijk} refers to the weight of index C_k under the index weight w^b_{ij} of criterion layer II.

From the formula, $CI^C=CI^{(C)}W^B$ and $RI^C=RI^{(C)}W^B$ can be obtained. $CI^{(C)}$ and $RI^{(C)}$ refer to the corresponding consistency index vector and random consistency index vector, respectively, of the judgment matrix in Criterion Layer II; thus, the combined consistency ratio index of the Project Layer was

$CR^C=CR^B+CI^C/RI^C \rightarrow (7)$

The calculated CR^B values of all experts were less than 0.1, which indicates that the judgment of each expert concerning the entire evaluation system complied with the requirements of consistency. Weight vector W_C of the Project Layer can be used as the final weight of each expert. The results are shown in Table 1.

Calculation of comprehensive weight

Because different experts may have different understandings regarding a problem, expert weight can be established according to their levels of understanding concerning this problem. When the distances between the combined consistencies index CR_i^c of expert i and 0.1 are farther apart, the reliability of the score and the reliability of the weight are higher. Therefore, expert weight was defined as

$$W_i^E=\frac{0.1-CR_i^C}{\sum_{i=1}^{10}\left(0.1-CR_i^C\right)}\quad (i=1,2,\ldots,10) \rightarrow (8)$$

The final comprehensive weight vector of the Project Layer to the Target Layer was obtained according to the layer analysis weight W_i^C of expert i calculated with Equation 6 and the expert weight W_i^E calculated with Equation 8. The results are shown in Table 2.

$$W=(\omega_k)_{37\times 1}=\sum_{i=1}^{10}W_i^EW_i^C \rightarrow (9)$$

Results and Discussion

From the weights of the 37 indexes in the Project Layer, “reverence for life” had the highest weight (0.066), followed by “bioethics” and “ability to express empathy”. “Basic principles of medical ethics”, “privacy protection”, “ability to empathize”, “ability to build trust”, “ability to communicate in an influential way”, “empathic concern” and “medical morality” were rated among the top ten. “Perception of traditional and modern medical history” had the lowest weight.

“Reverence for life”, the core, premise and basis of medical humanistic qualities, ranks highest in this field. Albert, a contemporary thinker and one of the greatest humanists of the last century, proposed that expressing a devout attitude towards life is a vital characteristic and behavior style [9]. Accordingly, “reverence for life” is given the highest comprehensive weight

The weights of the three indexes of “ability to empathize” in the Project Layer all ranked in the top 10. Considering the job specifications of medical practitioners, the ability to empathize undoubtedly plays an important role in the doctor-patient relationship. Whether medical practitioners can observe and feel the pain that patients are experiencing determines which emotions they reveal and attitudes they express. The attitude of medical practitioners further influences how patients judge whether they have received sufficient understanding and concern and determines the successful establishment of mutual trust between doctors and patients. Many studies also

emphasize the important role that the ability to empathize plays in establishing and maintaining a good doctor-patient relationship. Charles et al. have indicated that the ability to empathize is the spiritual basis of healing relationships [10]. Halpern has also suggested that in internal medicine, accurate medical judgments made between patients and doctors reflect a higher level of empathy, which always leads to improved nursing care and treatment [8].

Regarding the knowledge of medical ethics, two items were rated among the top ten, and their effects on the humanistic qualities of medical practitioners cannot be ignored. Both the rapid development of medical technologies and the changing life experiences of people have created new requirements for medical practitioners in the area of medical ethics, especially in organ transplantation, hospice care, euthanasia, etc. Therefore, medical ethics is inevitably one of the important factors that affect the humanistic qualities of medical practitioners. David et al. have emphasized that medical ethics and humanities education are essential to professional development in medicine [11].

Concerning "clinical communication skills", two items were rated among the top ten and were notably influencing factors. A good doctor-patient relationship is the basis for diagnosis and treatment, and clinical communication skills are a prerequisite to accurate diagnosis and treatment. Good communication skills are essential to guide patients to accurately describe their symptoms and to understand and accept medical advice. Good communication also promotes mutual cooperation among medical practitioners, the effective management of emergencies and the proper resolution of doctor-patient conflicts. Robyn et al. have found that unsuitable doctor-patient communication was the key reason for a poor doctor-patient relationship [12]. Studies by Fatima and Abdulla have demonstrated that professionalism and communication skills are two significant parts of the entire essence of a doctor's character [13].

To further verify the applicability of the comprehensive evaluation model, 56 persons who had passed the medical licensing examination were interviewed. They were evaluated on 37 indexes of the Project Layer, and the full mark of each index was 10. The comprehensive evaluation model for the humanistic qualities of medical practitioners is as follows:

$$W = (\omega_k)_{37\times 1} = \sum_{i=1}^{10} W_i^E W_i^C \rightarrow (9)$$

In this formula, ω_k refers to the comprehensive weight in Table 1 and refers to the score of index k of evaluation object *t*.

In general, the most common application is to take the mean value of the evaluation indexes. However, the indexes vary in terms of the degree of importance compared with the overall system; therefore, the mean value method is not scientifically rigorous. The comprehensive evaluation of 56 subjects with AHP and the mean value method were compared below. The results are shown in Table 3.

As shown in Figure 2, the evaluation results of AHP and the mean value method differed greatly. A paired sample t test was conducted for the two evaluation results of the 56 subjects. The results are shown in Table 2.

Table 2 indicates that (1) the evaluation results of AHP were higher than those of the mean value method, (2) these two results were significantly correlated, and (3) the results of a paired sample t test were t=7.38 and p<0.05, which indicates that the two methods had significant differences. Although the two methods correlated, the evaluation results of AHP were higher than those of the mean value method and better reflected the differences of the indexes. Therefore, AHP was a more scientific evaluation method; (4) according to Equation 9, once 37 results of the evaluation objects were received, the results of the comprehensive evaluation could be obtained.

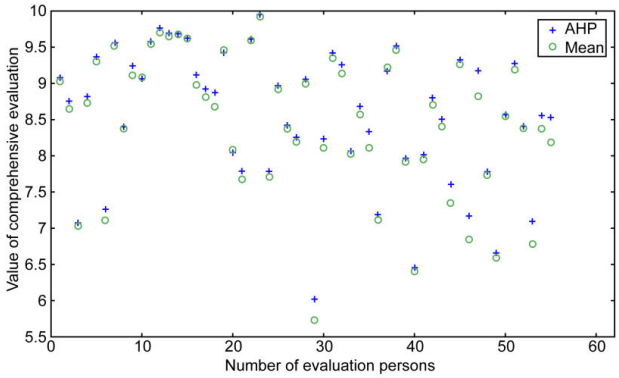

Figure 2. *Comparison of evaluation results between AHP and the mean value method. This plot shows the evaluation results ranging from 0 to 10 for 56 interviewees who had passed the medical licensing examination. Each data point refers to the evaluation value (Y axis) for each interviewee (X axis for the interviewee number). Blue data points indicate the results from the method using the Analytic Hierarchy Process (AHP), while green circles indicate the results from the mean method model (Mean).*

Table 2. *Comparison of the evaluation results of the analytic hierarchy process and mean value method.*

	Mean value	Correlation analysis	Paired sample t test
Evaluation results of analytic hierarchy process	8.58	r=0.996	t=7.38
Evaluation results of mean value method	8.48	p =3.45 × 10^{-58}	p=8.71 × 10^{-10}

Conclusions

Our work provides a comprehensive evaluation system that, for the first time, combines three essential elements together: knowledge of medical humanistic qualities, the ability to practice medical humanistic qualities and the spirit of medical humanistic qualities. This combined evaluation model is objective, effective and practical to evaluate the humanistic qualities of medical practitioners and is suitable to guide the selection and evaluation of personnel in practice, at least in Mainland China.

Table 3. *Evaluation index system for the medical humanistic qualities of medical practitioners.*

Medical humanistic knowledge (A1)	Knowledge of medical ethics (B1)	Basic principles of medical ethics (C1)
		Clinical diagnosis and treatment ethics (C2)
		Bioethics (C3)
	Knowledge of medical psychology (B2)	Basic theory of medical psychology (C4)
		Stress and mental disorders (C5)
		Psychological intervention and patient psychology (C6)
	Knowledge of health law (B3)	Management of physicians and medical institutions (C7)
		Management of disease control and diagnosis treatment (C8)
		Drug and blood management code (C9)
	Knowledge of philosophy, history, behavior and sociology (B4)	Medical pattern (C10)
		Traditional and modern medical history (C11)
		Social and cultural aspects of health and disease (C12)
		Doctor-patient interaction (C13)
		Behavior and health (C14)
Medical humanistic ability (A2)	Psychological adjustment ability (B5)	Adaptability (C15)
		Emotional stability (C16)
		Anti-frustration ability (C17)
		Growth ability after stress (C18)
	Empathic ability (B6)	Empathic ability (C19)
		Emotional empathic ability (C20)
		Ability to express empathy (C21)
	Clinical communication ability (B7)	Ability to build trust (C22)
		Participatory communication (C23)
		Influential communication skills (C24)
	Clinical thinking ability (B8)	Comprehension ability (C25)
		Discrimination ability (C26)
		Processing ability (C27)
		Reflection ability (C28)
Medical humanistic spirit (A3)	Humanistic philosophy (B9)	Reverence for life (C29)
		Respect for patients (C30)
		Understanding of patients (C31)
	Medical ethics (B10)	Medical morality (C32)
		Personal qualities (C33)

	Protection of privacy (C34)
Sense of responsibility (B11)	Self-responsibility (C35)
	Team responsibility (C36)
	Social responsibility (C37)

Future Direction

Some limitations of this study and future directions should be mentioned. First, the use of a questionnaire for data collection in the field is known to be often affected by information bias of part of the subjects. However, this problem was minimized by formal training provided by the field investigators prior to the commencement of the study, in addition to other quality control measures that were meticulously implemented. Second, the data collection was restricted to Mainland China. Whether the implication can be applied to other countries requires future investigation. Third, more definitive conclusions could be drawn by increasing the number of samples. Fourth, this is just an evaluation system. More future work is needed to implement this system into the medical education system. Altogether, further large-scale population surveys and interviews that are not restricted to China should be performed to gain a deeper understanding of the importance of humanistic qualities in health management and to provide a more reliable theoretical basis to improve the health management system.

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