

Development of the NHS Job Evaluation Tool: A Quantitative Study of Nurses in China

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Abstract

Aim: Based on the National Health Service job evaluation scheme, we aimed to construct a quality indicator for Chinese nurses.

Background: Because most nurses' low job satisfaction has led to a high turnover rate, establishing a job evaluation system that truly reflects nurses' values has become the core of Chinese nursing work reform.

Methods: Based on the literature review and Delphi method, a questionnaire containing 30 items was designed. By stratified sampling, nurses from six tertiary public hospitals in Beijing were selected. We collected 701 valid questionnaires. SPSS 24.0 was used to extract factors and analyze the questionnaire's reliability and structural validity.

Results: We retained 26 factors and divided them into four dimensions: Knowledge and Skills, Responsibility, Work/Environment, and Task Characteristics according to principal component analysis. The Cronbach's α of four dimensions ranged from 0.890 to 0.923, indicating high reliability. The Kaiser-Meyer-Olkin value was 0.960, demonstrating good structural validity.

Conclusions: The improved job evaluation system has strong reliability and validity and reflects the nurse's job characteristics scientifically.

Implications for Nursing Management: Nursing managers can apply this job evaluation model to formulate nurses' performance evaluation standards to improve their comprehensive ability.

1. Background

Nurses are crucial in achieving universal health coverage and global sustainable development goals (Taylor et al., 2020). Nursing staff account for approximately 59% of health professionals and are the largest professional group in health sector. They are playing an integral part in aging care and hospice programs. However, the shortage of nurses has become a global problem (Sermeus et al., 2011). The number of nursing staff shortages will reach 5.7 million by 2030, most of which are concentrated in low- and middle-income countries (2020a). In addition, nurses' turnover rate is as high as 40%, and the global population over 60 years old will increase to 1.4 billion by 2030. This series of problems makes the nursing industry face severe challenges (Marc et al., 2019).

Classical economic theory interpreted income level as a significant factor in employee turnover (Drennan & Ross, 2019). The National Federation of Nurses Associations in Taiwan also found that about 60% of nurses' resignation reasons are related to "salary and bonus", "heavy workload", and "work-life imbalance" (Chen et al., 2020). However, the income of nurses in most countries is lower than the average salary in that country (WHO, 2016). A survey from China shows that 83.7% of nursing staff believe that salary is the most important motivating factor in their work, but 76.5% of nurses have a monthly income lower than the average salary in first-tier cities (735\$), which directly leads to the low quality and the

decline in patient satisfaction. How to distribute salaries and retain nurses has become a challenge faced by almost all countries(2020a).

Job evaluation is considered to be the basis for scientifically formulating the salary distribution system and maintaining fair competition in the organization, and it plays a key role in human resource management(Zhang et al., 2021). Job evaluation refers to the design of a reasonable salary structure by comparing the job's relative value. It is mainly divided into four methods: ranking, classification, job component, and point system. The point factor method is more commonly used. The point factor method decomposes specific job tasks into four aspects: skills, responsibilities, effort, and working environment based on organizational strategy and job characteristics. In 1990, the United Kingdom adopted the point factor method to design the National Health Service (NHS) job evaluation system. The system includes five evaluation dimensions and 16 specific indicators with different weights. Compared with other systems, the NHS has strengthened the importance of knowledge factors, with a total score of up to 240 points, accounting for 24 of all factors. Furthermore, responsibility factors accounted for 36%, authority factors accounted for 6%, skill factors accounted for 24%, and effort and environmental factors accounted for 10%. Therefore, the NHS job evaluation system is a universal system with high authority and feasibility.

Establishing a job evaluation system that truly reflects nurses' values has become a central topic in China's nursing work reform. The Chinese government issued a notice on 2 September 2020, requiring reasonable adjustments of nursing service prices and nursing service costs accounting, gradually straightening out the relationship between nursing service prices and mobilizing nurses' enthusiasm (2020b). At present, public hospitals in China implement a job performance wage system. The nursing staff's wages include job wages, salary scale wages, performance wages, and allowances and subsidies, but the evaluation system has not been effectively implemented. Most public hospitals in China are run by the government and belong to public institutions. Therefore, nurses' job evaluation in public hospitals mainly focuses on job salary, and less considers job skills, job environment, and responsibility risk factors in nursing work and cannot truly reflect the value and transfer of nurses' labor services—the work enthusiasm of nurses (Xin & Lijuan, 2020). An empirical study of 25 hospitals found that 53.4% of nurses believe that the current salary distribution method is unreasonable(Liping et al., 2011). Moreover, there is a widespread phenomenon of “different pay for the same work” in hospitals. Nursing staff with a permanent job and nursing staff with contract jobs have the same job but the salary difference is considerable. The staff's salary with contract jobs is only 40–70% of the staff with permanent jobs(Pinghua et al., 2018; Yanlin, 2019; Zhong et al., 2016).

Job evaluation models from experienced countries were peachy guides for reforming the juxtaposition of Chinese nursing staff. The auspiciousness of the NHS job evaluation system is solving the internal inequity in salary distribution of medical staff. Because of the differences in each country's economic level and organizational culture, we revised the NHS job evaluation system, selected relevant evaluation factors through literature research and the Delphi method, and formulated a questionnaire suitable for

evaluating nurses in public hospitals in China. We tested whether the questionnaire is reliable and valid to draw statistical and logical significance.

2. Methods

2.1 Questionnaire design

Because of the evident merits of the 'Point factor method', we decided to use it to build the nurses' job evaluation model. The Delphi method was used to select the preliminary assessment elements and indicators ground on an extensive literature review. We adopted 'Job evaluation, point factor method, job analysis model' as keywords by searching in the PubMed, Web of Science, Google, CNKI, Wan Fang, CBM and OVID database. Then we collected and classified all the 'points', plus their corresponding frequency. Considering that the national conditions of each country are different and that China is the most populous country in the world, it faces a more complicated situation when evaluating work than the United Kingdom, so we retained 16 factors from the NHS job evaluation system and included another 14 factors from other job evaluation models drafted by government or advisory body (2008, 2010, 2017; Johnson et al., 2015). After that, we invited 20 Chinese experts to conduct two rounds of Delphi consultations, helping us winnow the above elements further. Experts recognized these 30 indicators and further explained these factors' connotation to design the scale question later. These connoisseurs showed great representativeness and reliability; the expert authority coefficient for all items was higher than 0.8. Ultimately, the final versions of the questionnaire contained 30 items, and each was rated by a 5-point Likert scale, running from 'extremely significant' (5 points) to 'totally insignificant' (1 point). Fifty nurses from a tertiary public hospital in Beijing participated in the pretest to determine the questionnaires' reliability and validity. The result shows that the overall Cronbach's α was 0.955, and the test-retest reliability coefficient was 0.960, demonstrating satisfactory reliability. The Kendall coordination coefficient for all items and the Bartlett's Test of Sphericity were significant ($p < 0.05$). Furthermore, Kaiser-Meyer-Olkin was valued at 0.960. Consequently, the questionnaire had great structural validity.

2.2 Sample selection

Samples of this study were selected by a multistage sampling design, which included the following two steps.

First step: According to the statistical yearbook, the six districts with the densest public hospitals in Beijing were selected, and one tertiary public hospital was selected in each district through cluster sampling, and six hospitals were finally determined as the research objects. Each of them holds 800 to 1500 beds, plus 1200 to 3500 staff.

Second step: A total of 800 nurses were selected by random sampling from the above six public hospitals to participate in the questionnaire survey.

2.3 Data processing and statistical analysis

After collecting the questionnaire, we utilised Microsoft Excel 2016 for basic data processing. The questionnaire's exclusion criteria include three principles: 1) Three or more items were not answered; 2) The answers to all items were the same; 3) The response showed a prominent circular mode. Moreover, after entering all the data, we selected 5% of the data to assure the data input accuracy.

SPSS 24.0 was used for statistical analysis. We primarily carried out principal component analysis with a varimax rotation to extract features and reduce dimensionality. Then we saved the factors whose Eigenvalue was greater than one but extracted the items whose factor load was less than 0.5 from the analysis. In addition, we applied the Cronbach's α to estimate the reliability of the scale and analysed the correlation among the items from the identical dimension and different dimensions. The Kaiser-Meyer-Olkin value was used to test the questionnaire's validity.

3. Results

3.1 Demographics of respondents

We distributed 800 questionnaires and recycled 721 among them, which means the response rate was 90.1%. Besides, after data preprocessing, we identified 701 valid questionnaires with a validity rate of 97.2%. The demographic characteristics of the samples were depicted in Table 1. Because female nurses accounted for the majority in China, 79.6% of our respondents were female, and 45.9% were under 30, while 33.1% were between 30 to 39 years old. Compared with physicians, 60.6% of selected nurses did not have a Bachelor's Degree, and 59.6% were attending nurses. Beyond half of them had been working within ten years. Regarding departments, 96.3% of respondents were from clinical divisions and almost equally distributed among six sampling hospitals. There were no significant differences between the exploratory and confirmatory samples ($p > 0.05$), illustrating the data had gratifying conformance.

Table 1
Demographic characteristics of respondents (N = 701)

Variable	Items	Total (N = 701)		Exploratory Samples (N = 353)		Confirmatory Sample (N = 348)		p-value
		N	%	N	%	N	%	
Gender	Male	143	20.4	80	22.7	63	18.1	0.053
	Female	558	79.6	273	77.3	285	81.9	
Age (years)	< 30	322	45.9	154	43.6	168	48.3	0.376
	30–39	232	33.1	116	32.9	116	33.3	
	40–49	125	17.8	71	20.1	54	15.5	
	≥ 50	22	3.2	12	3.4	10	2.9	
Education level	Not obtain Bachelor's	425	60.6	204	57.8	221	63.5	0.304
	Bachelor's	256	36.5	140	39.7	116	33.3	
	Master's	16	2.4	7	2.0	9	2.6	
	PhD	4	0.5	2	0.5	2	0.6	
Title	Attending	418	59.6	203	57.5	215	61.8	0.430
	Junior attending	258	36.8	138	39.1	120	34.5	
	Senior attending	25	3.6	12	3.4	13	3.7	
Level of position	Head of department	5	0.7	2	0.6	3	0.9	0.912
	Group leader	64	9.1	35	9.9	29	8.3	
	General staff	632	90.2	316	89.5	316	90.8	
Working time (years)	≤ 5	214	30.5	102	28.9	112	32.2	0.152
	6–10	179	25.5	86	24.4	93	26.7	
	11–15	121	17.4	70	19.8	51	14.7	
	16–20	57	8.1	23	6.5	34	9.8	
	21–25	75	10.7	45	12.8	30	8.6	
	26–30	38	5.4	18	5.1	20	5.7	
	> 30	17	2.4	9	2.5	8	2.3	
Departments	Clinical	675	96.3	336	95.2	339	97.4	0.133

Department						
Medical Technical Department	21	3.0	15	4.2	6	1.7
Administrative Department	5	0.7	2	0.6	3	0.9

3.2 Descriptive statistics of the research variables

As can be seen from Table 2, the 30 items' general score varied from 3.8 to 4.7, with an average score of 4.3. The item with the maximum value was Professional Knowledge (4.7 ± 0.66), while the item with the minimum value was Responsibilities for research and development (3.8 ± 0.81). The standard deviations varied from 0.66 to 0.86, indicating a high degree of aggregation of the data.

Table 2
Descriptive statistics of the job evaluation factor questionnaire (N = 701)

Factors	Minimum	Maximum	Mean	Standard Deviation
Professional knowledge	2	5	4.7	0.66
Knowledge Multiple	1	5	4.4	0.74
Knowledge updates	1	5	4.5	0.68
Experience	2	5	4.5	0.67
Training	1	5	4.4	0.73
Communication and relationship skills	1	5	4.5	0.67
Planning and organizational skills	1	5	4.2	0.72
Analytical and judgemental skills	1	5	4.3	0.74
Emergency response skills	1	5	4.5	0.69
Emergency response skills	1	5	4.2	0.80
Innovation skills	1	5	3.9	0.81
Operation capacity	2	5	4.5	0.68
Responsibilities for patient/client care	1	5	4.4	0.70
Responsibilities for teaching and supervising	1	5	4.1	0.74
Responsibilities for research and development	1	5	3.8	0.81
Responsibilities for policy and service Development and implementation	1	5	4.1	0.81
Responsibilities for human resources	1	5	4.1	0.82
Responsibilities for financial resources	1	5	4.0	0.86
Responsibilities for information resources	1	5	4.0	0.78
Awareness of quality and safety	1	5	4.1	0.71
Physical effort	1	5	4.3	0.80
Mental effort	1	5	4.3	0.73
Emotional effort	1	5	4.4	0.74
thinking environment	1	5	3.9	0.79
Working conditions	2	5	4.5	0.65
Freedom to act	1	5	4.3	0.78

Factors	Minimum	Maximum	Mean	Standard Deviation
Task relevance	1	5	4.1	0.79
Task complexity	1	5	4.2	0.74
Task coordination	1	5	4.2	0.75
Temporal characteristics	1	5	4.3	0.75
Mean			4.3	0.74

3.3 Factor analysis and dimensions

Through further analysis of the data, the Bartlett's Test of Sphericity was significant ($p < 0.05$), and the Kaiser-Meyer-Olkin value was 0.960, showing the rationality of principal component analysis for extracting key factors. We ultimately retained the principal components that eigenvalues were greater than one and defined them as four dimensions of nurses' job evaluation model. They accounted for 65.07% of the total variance cumulatively.

Then we exploited varimax rotation to convert the above components into easily interpretable factors. All items with factor loadings over 0.5 were included, so we deleted four items (Innovation skills, Awareness of quality and safety, Responsibilities for patient/client care, thinking environment), leaving 26. Due to the definitions of the remaining items under each dimension, we named four dimensions as Knowledge and skills (10 items), Responsibility (6 items), Effort/Environment (5 items) and Task characteristics (5 items). Table 3 summarized the factor loadings for each item.

Table 3
Factor loadings by principal component analysis (N = 701)

Factor	Knowledge & skills	Responsibility	Effort/ Environment	Task Characteristics
Knowledge updates	0.784	-	-	-
Professional Knowledge	0.758	-	-	-
Knowledge Multiple	0.755	-	-	-
Experience	0.741	-	-	-
Training	0.690	-	-	-
Communication and relationship skills	0.619	-	-	-
Planning and organizational skills	0.598	-	-	-
Emergency response skills	0.596	-	-	-
Analytical and judgemental skills	0.596	-	-	-
Operation capacity	0.564	-	-	-
Responsibilities for human resources	-	0.816	-	-
Responsibilities for policy and service development and implementation	-	0.805	-	-
Responsibilities for financial resources	-	0.777	-	-
Responsibilities for research and development	-	0.762	-	-
Responsibilities for information resources	-	0.686	-	-
Responsibilities for teaching and supervising	-	0.513	-	-
Emotional effort	-	-	0.803	-
Mental effort	-	-	0.797	-
Physical effort	-	-	0.788	-
Working conditions	-	-	0.727	-
Freedom to act	-	-	0.531	-

Factor	Knowledge & skills	Responsibility	Effort/ Environment	Task Characteristics
Task complexity	-	-	-	0.784
Emergency response skills	-	-	-	0.748
Task coordination	-	-	-	0.681
Task relevance	-	-	-	0.630
Temporal characteristics	-	-	-	0.523

3.4 Reliability and validity analysis

The Cronbach's α of the raised four dimensions were between 0.890 to 0.923, and each items' coefficient was displayed in Table 4. Moreover, according to the corrected item-total correlation, the system's items and dimensions' both had a good reliability. Apart from that, the correlation coefficients among items within the same dimensions were all over 0.593, which meant all these factors presented great consistency.

Table 4
Reliability analysis of the job evaluation factor system for nurses (N = 701)

Factor	Corrected item-total correlation	Cronbach's Alpha if item deleted	Cronbach's Alpha
Knowledge updates	0.668	0.953	0.923
Professional Knowledge	0.604	0.954	
Knowledge Multiple	0.630	0.953	
Experience	0.657	0.953	
Training	0.695	0.953	
Communication and relationship skills	0.659	0.953	
Planning and organizational skills	0.657	0.953	
Emergency response skills	0.720	0.952	
Analytical and judgemental skills	0.689	0.953	
Operational capacity	0.630	0.953	
Responsibilities for human resources	0.642	0.953	0.898
Responsibilities for policy and service development and implementation	0.642	0.953	
Responsibilities for financial resources	0.593	0.954	
Responsibilities for research and development	0.593	0.954	
Responsibilities for information resources	0.625	0.953	
Responsibilities for teaching and supervising	0.681	0.953	
Emotional effort	0.651	0.953	0.896
Mental effort	0.671	0.953	
Physical effort	0.606	0.954	
Working conditions	0.633	0.953	
Freedom to act	0.700	0.953	
Task complexity	0.667	0.953	0.890
Emergency response skills	0.677	0.953	
Task coordination	0.719	0.952	

Factor	Corrected item-total correlation	Cronbach's Alpha if item deleted	Cronbach's Alpha
Task relevance	0.727	0.952	
Temporal characteristics	0.604	0.954	

As shown in Table 5, there was also exceptional consistency between the four dimensions, as their correlation coefficients were greater than 0.526. Task and Effort/Environment were the most correlated ($r = 0.738$). However, Effort/Environment and Responsibility were the least correlated ($r = 0.526$).

Table 5
Inter-correlations of the four dimensions (N = 701)

Dimension (Mean/Standard Deviation)	Knowledge & skills	Responsibility	Effort/Environment	Task Characteristics
Knowledge & skills (4.45/0.54)	1	-	-	-
Responsibility (4.04/0.65)	0.643**	1	-	-
Effort/Environment (4.34/0.64)	0.604**	0.526**	1	-
Task Characteristics (4.21/0.64)	0.665**	0.568**	0.738**	1
**denotes statistical significance at $p < 0.01$.				

As for validity, the results of factor analysis proved that our model had qualified structural validity. Based on mature job evaluation schemes and Delphi method, the content validity can be well determined. As a result, the nurse job evaluation system possessed both reliability and validity.

4. Discussion

Based on the above research, we finally constructed a job evaluation system with four dimensions and 26 basic projects to scientifically and equally evaluate nurses' work and performance in Chinese public hospitals. Compared with the previous uniformly distributed system, our study had a satisfactory reliability and validity with Cronbach's α all above 0.8.

Feature of Chinese nurse job evaluation

Chinese nurse job evaluation scheme combines the nursing industry's latest development trends and can reflect the characteristics of nurses' work. First, people's increasingly diversified health needs and the accelerated change of knowledge place higher demands on nursing staff's Knowledge and skills. In view of Chinese nurses' weak ability to translate theory into practice(Jinnan, 2016), China issued a standardized training program for new nurses in 2016(Zhuangzhi et al., 2020). These characteristics can be reflected in the knowledge/skills dimension (10 factors). Second, to ensure patient safety, the Ministry of Health puts forward the concept of responsible holistic care, requiring nurses to provide patients with comprehensive and continuous services(Xia & Pengjuan, 2016). Besides essential nursing work, nurses are also responsible for policy implementation and economics of medical consumables usage. These characteristics can be reflected in the responsibility dimension (6 factors). Third, with the rapid increase in the number of doctors in China and the particularity of nursing work, nurses are under increasing pressure in terms of physiology, psychology and emotion(Xin et al., 2020). Research shows that work flexibility is the primary source of occupational pressure for nurses(Changrong et al., 2011). These characteristics can be reflected in the effort/environment dimension (5 factors). The frequent occurrence of new infectious diseases and emergency patients' increase put forward higher requirements for nurses' task processing ability. These characteristics can be reflected in the task dimension (5 factors).

Chinese nurse job evaluation scheme reflects the prospective requirements

Communities will become primary nursing service providers rather than public hospitals responding to China's aging population. The working condition elements in the environmental dimension take into account the change in this situation. China considered expanding its tiered delivery approach of three to four tiers, namely adding the tier of supplying health care for the elderly at home, which motivated by integrating medical and social care since health care reform(Yip et al., 2019). With the ministrations of Internet plus Health initiatives, prospective nursing service requires nurses to master some up-to-date skills, like operating computers and other electronic devices, understanding electronic medical records. These requirements are reflected in the knowledge-skill dimension and the responsibility dimension. Moreover, nurses should raise their patient-centered awareness, improve their patience and communication skills, and finally increase customer satisfaction. The requirements of this section are reflected in the emotional effort elements of the Effort / Environment dimension. Apart from that, due to the tendency for nursing is not only limited to clinical treatment but also to attach more attention to chronic disease prevention, the future requirements for nurses should also be adjusted. They need to keep track of patients' health records, regularly visit them. Thus patients' health status, yearly hospital admission rate, should be included to evaluate nurses' jobs. Task complexity elements in the task dimension can reflect the content of this part.

Comparative analysis of two job systems

Compared with NHS job evaluation system, as shown in Table 6, Chinese nurse job evaluation scheme has added one dimension, totaling four dimensions, which is one dimension less than NHS job evaluation system. Specifically, we added a dimension of Task Characteristics, and merged the Knowledge dimension and Skill dimension into one dimension, and combined the Effort/Environment dimension and the Freedom dimension of action into one dimension. First of all, unlike other countries, Chinese public hospitals are the leading providers of medical services, undertaking a large number of medical service tasks, and the work tasks of nurses in different positions are quite different. This leads nurses to undertake many tasks beyond their duties. Therefore, we have increased the dimension of Task Characteristics. Second, according to the results of factor analysis, we merged the dimensions of Knowledge and Skills. The continuous updating of professional knowledge in the medical industry puts forward higher requirements for nurses' ability in public hospitals, and the professional knowledge and practical skills complement each other, so the combination of the two is reasonable. Thirdly, This may be due to the large population of China and the heavy workload in the public hospitals, and nurses need to communicate with doctors, patients and other parties at the same time, their autonomy in action may be restricted by the surrounding environment, so our Effort/Environment dimension is combined with the Freedom dimension of action.

Table 6
The dimensions of two job evaluation systems

Nurses job evaluation system	NHS JE
Knowledge& Skills	Knowledge
Effort/ Environment& Freedom to act	Skills
Responsibility	Responsibility
---	Freedom to act
Task Characteristics	Effort/Environment

There are also some differences in specific factors. On the one hand, nurses spending plenty of time of a day communicating and coordinating with doctors and patients, and the number of nurses in China is not enough, so we add five factors: task complexity, emergency response, task coordination, task relevance and time characteristics. On the other hand, the speed of knowledge renewal in modern society is accelerated, and patients' needs and the situation of diseases are more complex, which requires higher comprehensive quality of individuals. Therefore, we have added six factors in Knowledge and skill dimension, such as training, communication and relationship skills, planning and organization skills, emergency response skills, analytical judgment ability, work ability. Therefore, we have added training, communication and relationship skills, planning and organization skills, emergency response skills, analysis and judgment skills, and six factors of work ability. (Most public hospitals in China have teaching tasks. In addition to carrying out a lot of education to patients, nurses need to guide and teach advanced nurses, intern nurses and junior nurses). Therefore, we have added teaching and supervision

responsibilities to the dimension of responsibility to ensure that nursing students and patients receive comprehensive guidance from nurses.

The application of Chinese nurse job evaluation scheme

As for applying this work system, it can be used to evaluate the job characteristics of nurses because its four dimensions, namely “knowledge and skills, responsibilities, effort/environment and task characteristics,” relatively completely cover 701 recipients. All the factors most concerned by the interviewer reflect their expectations. In addition, the system can also be used to determine reasonable post salary, personnel selection and appointment, formulate performance evaluation standards, and build career development plans(Yang et al., 2015). At present, two hospitals in China are already using this system, and the specific effect needs further evaluation.

5. Limitations

This study also contains some limitations. Our survey only investigated nurses from public hospitals in Beijing, which had a limited geographical range. In the following research, we should expand regions and improve nurses’ representative from the whole country. Second, the established nurses’ job evaluation system has only been implemented in two hospitals of Beijing. Thus, it is necessary to further verify its applicability through practice.

6. Conclusion

This study designs a model containing four dimensions and 26 specific factors to evaluate nurses’ work performance in Chinese public hospitals. The model is a reliable and valid system that reflects nurses’ position characteristics relatively scientifically. Our research fills up the current research and practice gaps and provides the essential basis for the comprehensive management of nursing human resources to achieve “equal pay for equal work, better pay for better work”.

7. Implications For Nursing Management

Nursing managers can use this job evaluation model to comprehensively evaluate nurses’ job value, improve nurses’ enthusiasm for work, and reduce their turnover rate. The information age poses more challenges to the work of nurses. Applying this model to nurses’ performance assessment will improve nurses’ overall quality in an all-around way so that patients can enjoy more satisfactory services. In addition, the method adopted in this study also has specific reference significance for other countries to establish reasonable work evaluation models.

Declarations

Ethical considerations:

The National Health and Family Planning Commission of the People's Republic of China (renamed as the National Health Commission of the People's Republic of China in 2018) manages the clinical review of biomedical research involving people and organizes the establishment of the National Medical Ethics Expert Committee. According to Measures for the Ethical Review of Biomedical Research Involving Humans, issued by the National Health and Family Planning Commission of the People's Republic of China in 2016, our study did not need formal ethics approval because this survey did not deliver any intervention to research participant and involved no more than minimal risk of harm to participants. The questionnaire surveys were anonymous and voluntary and written informed consent had been obtained from all study participants. All methods were performed in accordance with relevant guidelines and regulations.

Consent for publication:

Not applicable.

Data availability:

The datasets used during the study are available from the corresponding author on reasonable request.

Conflict of Interest:

No competing interests.

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Author contribution

JG contributed to the study design, data analysis and drafting the major portion of the manuscript. DZ contributed to the conceptual framework and data collection. FY and RJH contributed to data analysis and writing the manuscript. All authors critically reviewed the manuscript and approved the final version.

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References

1. (2008). *Mercer enhances international position evaluation system to allow for easy evaluation of positions worldwide* <https://www.prweb.com/releases/position/evaluation/prweb670354.htm>. Accessed 8 October 2020.

2. (2010). *Success application of job evaluation in consultation for hospital human resource management* <http://www.jnkhmc.com/newsShow.asp?newsTypeID=33&ID=674>. Accessed 15 October 2020.
3. (2017). Job family position classification standard for professional work in the medical and healthcare group 0600: U.S. Office of Personnel Management. Reprinted.
4. (2020a). *State of the World's Nursing Report - 2020* <https://www.who.int/publications/i/item/9789240003279>. Accessed 26 October 2020.
5. 2020b). Office of the National Health and Health Commission: Notice of the General Office of the State Health and Health Commission on further strengthening the nursing work of medical institutions
6. Changrong, C., Yachun, C., Wenxia, K., & Changping, C. (2011). path analysis of influencing factors of nurse work-family conflict. *Journal of Nursing Science*, 26(5)
7. Chen, Y. C., Guo, Y. L., Lin, L. C., Lee, Y. J., Hu, P. Y., Ho, J. J., & Shiao, J. S. (2020). Development of the Nurses' Occupational Stressor Scale [Journal Article; Research Support, Non-U.S. Gov't]. *Int J Environ Res Public Health*, 17(2) <http://doi.org/10.3390/ijerph17020649>
8. Drennan, V. M., & Ross, F. (2019). Global nurse shortages-the facts, the impact and action for change [Journal Article; Review]. *Br Med Bull*, 130(1), 25-37. <http://doi.org/10.1093/bmb/ldz014>
9. Jinnan, O. (2016). Research progress of nurses' core competence. *Journal of Nursing. Journal of Nursing Science*, 31(3), 98-101.
10. Johnson, P., McMullen, T., & Royal, M. (2015). Job evaluation: relevant, robust and reimagined. *Workspan*
11. Liping, L., Qinghua, Z., & Mingchao, X. (2011). Investigation on the status of quality nursing service demonstration project in 25 hospitals in Chongqing. *Journal of Nursing*, 18(23)
12. Marc, M., Bartosiewicz, A., Burzynska, J., Chmiel, Z., & Januszewicz, P. (2019). A nursing shortage - a prospect of global and local policies [Journal Article]. *INTERNATIONAL NURSING REVIEW*, 66(1), 9-16. <http://doi.org/10.1111/inr.12473>
13. Pinghua, Z., Weimin, W., Qiming, F., Yizhao, L., Xi, Z., Qiuqi, O., & Bo, W. (2018). Present situation and Reform Countermeasures of personnel compensation in Guangxi County Public Hospitals [Chinese Journal of Hospital Administration], 34(3)
14. Sermeus, W., Aiken, L. H., Van den Heede, K., Rafferty, A. M., Griffiths, P., Moreno-Casbas, M. T., Busse, R., Lindqvist, R., Scott, A. P., Bruyneel, L., Brzostek, T., Kinnunen, J., Schubert, M., Schoonhoven, L., & Zikos, D. (2011). Nurse forecasting in Europe (RN4CAST): Rationale, design and methodology [Journal Article]. *BMC Nurs*, 10, 6. <http://doi.org/10.1186/1472-6955-10-6>
15. Taylor, F., Drennan, V. M., Halter, M., & Calestani, M. (2020). Integration and retention of American physician assistants/associates working in English hospitals: A qualitative study [Journal Article]. *HEALTH POLICY*, 124(5), 525-530. <http://doi.org/10.1016/j.healthpol.2020.03.001>
16. WHO. (2016). Global strategy on human resources for health: workforce 2030. (Reprinted.

17. Xia, L., & Pengjuan, J. (2016). investigation and analysis of the overall nursing level of nurse responsibility system. *Chinese Community Doctors*, 32(3)
18. Xin, L., Xue, W., Ying, W., Xueqian, H., & Xi, C. (2020). a study on the relationship between occupational stress and mental health status of nurses in different departments and the level of job burnout, 46(5), 412-416.
19. Xin, L., & Lijuan, X. (2020). Nursing risk Assessment and its participation in Nursing performance Distribution. *General practice nursing*, 18(30), 4090-4093.
20. Yang, W., Dan, Z., Shuqiang, X., & Tieshan, Z. (2015). The establishment of nurse-related job evaluation element system for general hospitals and its reliability and validity analyses. *Chinese Nursing Management*(3), 272-276.
21. Yanlin, L. (2019). *A study on the compensation status of public hospital in Sichuan Province*, Chengdu University of traditional Chinese Medicine].
22. Yip, W., Fu, H., Chen, A. T., Zhai, T., Jian, W., Xu, R., Pan, J., Hu, M., Zhou, Z., Chen, Q., Mao, W., Sun, Q., & Chen, W. (2019). 10 years of health-care reform in China: progress and gaps in Universal Health Coverage [Journal Article; Review]. *LANCET*, 394(10204), 1192-1204. [http://doi.org/10.1016/S0140-6736\(19\)32136-1](http://doi.org/10.1016/S0140-6736(19)32136-1)
23. Zhang, D., Liao, M., Wang, P., & Chiu, H. (2021). Development and validation of an instrument in job evaluation factors of physicians in public hospitals in Beijing, China. (16, pp. e244584). (Reprinted.
24. Zhong, L., Minghui, L., Fei, W., Chunyu, W., Wei, C., Weiwei, Z., & Wen, F. (2016). Analysis of the scale and treatment of non-staff health technicians in county-level hospitals in China. *Chinese Journal of Hospital Administration*, 32(5)
25. Zhuangzhi, Z., Yao, C., Shuang, L., Xin, W., & Baofeng, D. (2020). research status of standardized training for new nurses. *Chinese General Nursing*, 18(31)