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ORIGINAL ARTICLE

Assessment of the Family Medicine Residency Training Environment in Guangdong, China, Based on the PHEEM: A Cross-Sectional Study

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ABSTRACT

Background and Objectives: The clinical learning environment exerts a profound influence on trainees' educational outcomes and professional development. Despite its recognized importance, no validated instrument currently exists to systematically assess this environment within family medicine residency programs in the Chinese context. This study aimed to evaluate the educational environment of family medicine residents in Guangdong Province, China, and to examine the validity of the Chinese version of the Postgraduate Hospital Educational Environment Measure (PHEEM) for this population.

Methods: In this multicenter cross-sectional study, 240 residents from six hospitals were surveyed using the 40-item Chinese version of the PHEEM (scored on a 5-point Likert scale). Principal component analysis with Varimax rotation was used to identify factors (eigenvalue >1).

Results: Three domains were identified—role autonomy, teaching, and social support—explaining 63.07% of total variance. Cronbach's α was 0.966 overall; subscale α values were 0.858, 0.969, and 0.890, respectively.

Conclusions: The PHEEM shows strong internal consistency and structural validity for assessing the family medicine residency learning environment in China. Further research is recommended to confirm its broader applicability.

INTRODUCTION

In contemporary China, the increasing demand for health care, driven by population growth, has prompted a shift in health care models from a specialist-dominated biomedical approach to a family medicine-led biopsychosocial framework. This transformation has catalyzed the rapid development of family medicine in the country. To become proficient family physicians, students undergo a comprehensive training pathway that includes 5 years of undergraduate education followed by 3 years of clinical internship. During the clinical training phase, the supervision and optimization of the educational environment are critical to ensuring the development of high-quality family physicians.

The educational environment typically comprises three key dimensions: the physical environment (eg, facilities, safety, food, accommodation), the emotional climate (eg, feedback, support, bullying/nonbullying), and the intellectual climate (eg, patient-centered learning, evidence-based care, structured educational programs).[1] The learning environment has a profound impact on trainees' learning strategies and the quality of their educational outcomes.[2] Trainee satisfaction with the learning environment is a key determinant of their future success. Over time, significant efforts have been made to design and implement tools for assessing the educational environment. A recent systematic review identified 31 distinct indices developed for various professional groups across global settings,[3–5] which have since gained widespread application in clinical training environments worldwide.

To date, no publicly available studies assess the educational climate in family medicine residency programs in China. Furthermore, currently no comprehensive, standardized, internationally validated tool is available for evaluating the educational environment in this context. This study aims to investigate the family medicine residency training centers in Guangdong Province, China, by using the widely validated Postgraduate Hospital Educational Environment Measure (PHEEM) questionnaire. The PHEEM has been validated across various specialties and international contexts, including

pediatrics in China,[6] surgery in Canada,[5] and family medicine in Saudi Arabia,[7] demonstrating its reliability and flexibility in postgraduate training assessment. The objectives are twofold: to validate a comprehensive, standardized, and internationally recognized tool for assessing the educational environment; and to evaluate the learning environment of family medicine residents at six major teaching hospitals in Guangdong Province in 2024.

METHODS

Study Design

We conducted a descriptive, multicenter, cross-sectional survey in 2024 across six teaching hospitals in Guangdong Province, China, all of which offer family medicine residency training programs. We employed stratified cluster sampling for participant selection. This study was reviewed and approved by The Third Affiliated Hospital of Southern Medical University Institutional Review Board. The province was stratified into four geographic and economic regions (Eastern, Northern, Western, and Pearl River Delta), and one or two tertiary-grade A teaching hospitals were randomly selected from each. The selected hospitals were as follows: Eastern Guangdong–Jieyang People's Hospital; Northern Guangdong–Heyuan People's Hospital and Yuebei People's Hospital; Western Guangdong–The Affiliated Hospital of Guangdong Medical University; and Pearl River Delta–The Third Affiliated Hospital of Southern Medical University and The Fifth Affiliated Hospital of Southern Medical University. All the selected hospitals are recognized family medicine teaching centers. We used the Chinese version of the PHEEM as the primary assessment tool.

The PHEEM consists of 40 specific items, divided into three subscales that assess role autonomy, perceived teaching, and perceived social support. Each item is scored on a 5-point Likert scale (0=strongly disagree, 4=strongly agree), with a maximum total score of 160. Among these, some items are negatively worded (items 4, 6, and 30—"I have been discriminated against due to race during my rotations"), which, considering the national context, was modified to "I have encountered discrimination due to my place of origin during my rotations." These items were reverse-scored, meaning that higher scores indicate a more positive environment. The scale takes approximately 8 to 10 minutes to complete. Total scores are summed (not averaged), ranging from 0 to 160. Interpretation of the results followed the guidelines proposed by Roff and colleagues: Excellent=scores greater than 120; More positives than negatives, room for improvement=80–120; Several issues=40–80; Very poor=0–40. Items with an average score of 2 or below were carefully reviewed, as they indicated areas of concern.[4] The questionnaire also collected demographic information such as gender, year of training, type of training, and training hospital.

Participants

Participants included residents from first to third training years, covering four categories:

- Residents of Social Standardized Training for Medical Practitioners (RSTM): full-time residents recruited through public exams for standardized training;
- Commissioned Students (CS): residents sponsored by hospitals with employment agreements;
- Professional Master Students (PMS): graduate students enrolled in academic master's programs with clinical rotations; and
- Advanced Study Students (ASS): practicing physicians pursuing additional training without formal employment contracts.

These categories reflect the diversity of residency training pathways in China and were treated collectively in the analysis, because all participants underwent the same core family medicine training rotations. All 312 eligible residents were invited; 240 responded (76.9%). Site-specific response rates ranged from 50% to 100%.

Procedure

For use of the Chinese version of the PHEEM,[6,8] we received permission from the translator and the original author.[4] Due to cultural and institutional differences, the PHEEM was translated and appropriately modified. For example, the statement "Racism exists in this post" was changed to "I have encountered regional discrimination during my rotations." The PHEEM electronic questionnaire was distributed to the residents in each hospital via the Wenjuanxing platform. All participants were informed about the study and invited to participate, with a requirement to read the informed consent form before completing the questionnaire.

Data Collection

The survey was distributed in November 2024 and remained open for 1 month. Weekly reminders were sent to nonrespondents. Scores were calculated by summing item responses, with reverse scoring applied where applicable.

Statistical Analysis

We used descriptive statistics to summarize the percentage, mean, standard deviation, and range between quartiles of the PHEEM scores. We assessed the internal consistency reliability of the PHEEM tool using Cronbach's α coefficient. To evaluate the construct validity of the three PHEEM subscales, we applied principal component analysis with varimax rotation to examine the internal structure of the PHEEM. Factor selection was based on three criteria: maximum variance orthogonal rotation, eigenvalue greater than 1, and the scree plot inflection point. We also considered the factor variance contribution rate. We used analysis of variance to compare the scores across different genders, training years, training types, and training hospitals. The significance level was set at $P<.05$, with all tests being two-tailed.

RESULTS

As shown in Table 1, we analyzed a total of 240 valid questionnaires, yielding a response rate of 76.9%. The overall mean

PHEEM score was 116.82, suggesting a generally favorable educational environment with room for improvement. Among the three subscales, "Teaching" received the highest average score (45.18), followed by "Role autonomy" (40.21), and "Social support" (31.43), which was the lowest. This pattern indicates that while teaching quality is well-perceived, aspects related to resident support warrant closer attention.

We performed exploratory factor analysis (EFA) using both the PCM1 vertical rotation and Varimax rotation techniques on the 40 items presented. The calculated Kaiser-Meyer-Olkin (KMO) index was 0.96, indicating adequate sampling adequacy. The KMO index ranges from 0 to 1, and values above 0.5 suggest that the data are suitable for factor analysis. Bartlett's test of sphericity was also statistically significant ($P<.001$), confirming that the correlation matrix was appropriate for factor analysis. After Varimax rotation, the factor loadings of the extracted components indicated that each item had higher loadings on its respective factor than on any other factor. In other words, the correlation of each item with its own factor was higher than with other factors.

The factor characteristics extracted from the research questionnaire are shown in Table 2. Note the factor loadings for Item 9 ("I have the opportunity to provide continuous care to a specific patient."), Item 11 ("I have opportunities to receive appropriate training to improve my skills during clinical practice."), and Item 30 ("I have experienced regional discrimination during my rotations.") were 0.280, 0.073, and 0.068, respectively, all of which were below the threshold of 0.4. We recommended that these items be considered for deletion or modification in future studies. All other items had factor loadings greater than 0.4, indicating good loadings on their respective factors and suggesting that no changes are necessary for the remaining items in the questionnaire. Therefore, using EFA, the 40-item questionnaire was reduced to three factors (representing the current variables). These three factors accounted for 63.689% of the total factor variance, which is an acceptable value. As presented in Table 3, the Cronbach's α values for all the items in the questionnaire reached an ideal and reliable level. Additionally, the overall Cronbach's α value for the entire questionnaire, consisting of 40 items and 240 samples, was calculated to be 0.966.

As shown in Table 4 , we found significant positive correlations between all study variables, indicating that changes in one variable would lead to changes in the others. Table 5 clearly shows the relationship between questionnaire scores and demographic characteristics. We found no significant differences in scores across the various domains of the questionnaire between different genders and training types. Furthermore, we found no significant differences or correlations between year of study and the questionnaire domains, except for social support. First-year residents had the lowest average scores. We used Pearson correlation coefficients to examine the relationships between variables (Table 5). To better reflect institutional-level training environment differences, we also calculated and reported the summary scores (total and subscale scores) for each of the six teaching hospitals (Supplementary Table 1).

DISCUSSION

This study represents the first use of the Chinese version of the PHEEM to assess the general practice training environment in China. The results indicate that the PHEEM tool is a reliable and effective instrument for evaluating both the characteristics of clinical teaching and the learning experiences of postgraduate trainees in clinical environments. The questionnaire is quick to administer and easy to use, demonstrating its practicality and suitability for widespread application in clinical teaching settings in medical schools. Furthermore, the Cronbach's α coefficient of the questionnaire reached an ideal reliability level, further validating its applicability and stability for assessing clinical education environments. These findings align with those of the Shanghai pediatric study, where the Cronbach's α of the Chinese PHEEM version was reported to be 0.966.[6] All other studies, including ours, have shown comparable results with Cronbach's α values greater than 0.8,[7,9–20] confirming the tool's capacity to effectively evaluate clinical education environments from the perspective of postgraduate trainees.

In terms of validity, the study used EFA to assess the structural validity of the tool. The EFA results confirmed that the data were appropriate for factor analysis and that the sample size was adequate. Factor loadings for all items in the questionnaire were above the threshold of 0.4, indicating that the items are well-aligned with their corresponding domains. Additionally, the factor loadings for each item on its designated domain were higher than those for other domains, supporting the internal consistency of the tool. Based on the results, no items need to be excluded or modified. The EFA further revealed that the PHEEM can be categorized into three core dimensions: role autonomy, clinical teaching quality, and social support, with these dimensions explaining 63.689% of the total variance. This outcome demonstrates that the tool's structure is both reliable and acceptable.

In the analysis of the scores, this study found that the total score of the Chinese version of the PHEEM (116.82) falls within the range of 80 to 120, indicating a generally positive perception of the educational environment among the trainees, with room for improvement. Similar average scores have been reported in both developed and developing countries, ranging from 82.64 to 118.7.[6,7,12,13,15,16,19,21–25] However, lower scores were observed in studies conducted in Pakistan, with a total score of 63.68,[26] and in Sudan, with a score of 74.66,[20] suggesting that these regions face more significant issues in their educational environments.

Regarding the dimensions of the PHEEM, this study found that the "Teaching" dimension had the highest score, while the "Social support" dimension had the lowest. This suggests that, although clinical teaching is generally highly rated by residents, social support remains an area requiring attention because it may impact the overall learning experience and professional development of trainees. This finding is consistent

TABLE 1. Demographic Characteristics of Participants in the Psychometric Evaluation of the Chinese Version of the PHEEM

Category	n (%)
Gender	
Male	136 (56.67)
Female	104 (43.33)
Year of training	
1st	88 (36.67)
2nd	69 (28.75)
3rd	83 (34.58)
Type of training	
RSTM	169 (70.42)
CS	58 (24.17)
PMS	11 (4.58)
ASS	2 (0.83)
Training hospital	
Heyuan People's Hospital	64 (26.67)
The Affiliated Hospital of Guangdong Medical University	44 (18.33)
Jieyang People's Hospital	47 (19.58)
The Third Affiliated Hospital of Southern Medical University	29 (12.09)
The Fifth Affiliated Hospital of Southern Medical University	22 (9.16)
Yuebei People's Hospital	34 (14.17)
Total	**240 (100.00)**

Abbreviations: PHEEM, Postgraduate Hospital Educational Environment Measure; RSTM, Residents of Social Standardized Training for Medical Practitioners; CS, Commissioned Students; PMS, Professional Master Students; ASS, Advanced Study Students

with related studies in Shanghai,[7] and similar results have been observed in other studies, where "Teaching" was rated the highest and "Social support" the lowest.[13–15,19,23,24,27] Social support plays a crucial role in residents' professional growth, making it an important area to improve in the clinical teaching environment. Furthermore, this study found no significant differences in the scores across different genders, years of training (except for the "Social support" dimension), or types of training, which aligns with findings by Al Helal et al in Riyadh.[7] However, some studies have reported that male residents tend to score significantly higher, and similar results were observed by Ezomike,[16] Sheikh,[22] González,[28] and Alele,[19] who found significant gender differences in PHEEM scores. These variations may be influenced by cultural expectations, social norms, and regional factors, suggesting that gender differences in perceptions of the educational environment warrant further investigation.

This study revealed notable differences in the perceived educational environment across the six participating teaching hospitals, as measured by the PHEEM instrument. Yuebei People's Hospital recorded the highest total PHEEM score (125.86), indicating a more favorable learning climate—particularly in the domains of "Teaching" and "Social support." In contrast, Heyuan People's Hospital had the lowest score (105.23), suggesting potential deficiencies in role autonomy and perceived institutional support (Supplemental Table 1). These interinstitutional discrepancies likely reflect underlying differences in institutional culture, faculty engagement, resource availability, and supervision practices, despite a shared provincial training framework.

Similar patterns of institutional variability have been documented in prior research using the PHEEM scale, where factors such as teaching quality, administrative responsiveness, and resident-supervisor dynamics were shown to exert substantial influence on learners' perceptions of their educational setting.[22,26,29] These findings underscore the need for localized quality improvement initiatives tailored to specific institutional contexts, especially for hospitals scoring lower in key domains. Establishing regional benchmarking mechanisms and enforcing minimum educational standards may help harmonize training quality across disparate sites.

In addition to institutional factors, this study also identified meaningful regional differences in residents' scores across various subscales. Such variability aligns with findings from Waheed et al,[26] who reported significantly higher scores among public hospital staff in Pakistan compared to those in private institutions. Potential contributing factors include disparities in regional economic development, hospital-specific educational strategies, and cultural norms. Variations in educational resources, training models, and sociocultural expectations may shape residents' evaluations and experiences differently, even within the same health

TABLE 2. Exploratory Factor Analysis: Factor Loadings

Item	Factor load value
1. I have been informed by the management about the required working hours each day.	0.582
2. I am able to attend practical lectures and training.	0.782
3. I am entrusted with an appropriate level of responsibility during my rotations.	0.757
4. I am required to perform inappropriate tasks during my rotations.	0.623
5. I can obtain accurate and complete medical records.	0.750
6. I often receive work-related phone calls outside working hours.	0.757
7. There is a clear clinical rotation plan during my rotations.	0.698
8. My working hours do not exceed the hospital's prescribed working hours.	0.595
9. I have the opportunity to provide continuous care to a specific patient.	0.280
10. I feel like I am part of the ward's working team.	0.555
11. I have opportunities to receive appropriate training to improve my skills during clinical practice.	0.073
12. The workload during my rotations is appropriate for me.	0.586
13. The training in this position has made me feel prepared for the next stage of my career.	0.512
14. My clinical supervisors and I show mutual respect.	0.553
15. My clinical teachers set clear learning expectations for me.	0.854
16. I have enough time for learning during my rotations.	0.866
17. I always receive excellent clinical guidance.	0.875
18. My clinical supervisors have excellent communication skills.	0.829
19. I can actively participate in some educational activities.	0.659
20. My clinical teachers are passionate about teaching.	0.787
21. The hospital offers educational programs related to my needs.	0.848
22. My senior doctors regularly provide me with feedback.	0.765
23. My clinical teachers have a well-organized teaching plan.	0.873
24. I have sufficient clinical learning opportunities to meet my needs.	0.875
25. My clinical teachers possess strong teaching skills.	0.766
26. It is easy for me to find my clinical supervisor when needed.	0.867
27. I can learn a lot from senior staff (doctors, nurses, etc).	0.770
28. My clinical supervisors encourage me to develop independence.	0.860
29. My clinical teachers provide good feedback on my strengths and weaknesses.	0.923
30. I have experienced regional discrimination during my rotations.	0.068
31. I have not experienced gender discrimination during my rotations.	0.834
32. I have good collaboration with other doctors at the same level.	0.828
33. I can receive appropriate career advice.	0.802
34. The hospital provides high-quality accommodation for rotation trainees, especially during on-call shifts.	0.669
35. I feel safe in the hospital.	0.834
36. During my rotations, the atmosphere in the rotation departments is good, and I am rarely reprimanded.	0.583
37. The hospital provides adequate meals during on-call shifts.	0.652
38. My clinical supervisors have excellent guidance skills (not limited to medical knowledge).	0.747
39. I enjoy my current work and study situation.	0.661
40. The hospital provides good mentoring for junior doctors facing difficulties during their rotations.	0.838

TABLE 3. Factor Analysis Extraction Results for Each Domain of the Chinese Version of the PHEEM

Domain	Cronbach's α	Eigenvalue	Variance explained (%)	Cumulative (%)	Items
Role autonomy	0.858	5.842	41.726	41.726	14
Teaching	0.969	1.733	12.380	54.105	15
Social support	0.890	1.255	8.967	63.072	11
Total	0.966				40

Abbreviation: PHEEM, Postgraduate Hospital Educational Environment Measure

TABLE 4. Correlation Matrix Between the Domains of the PHEEM

Domain	Role autonomy	Teaching	Social support
Role autonomy	1		
P	–		
Teaching	0.838	1	
P	0	–	
Social support	0.795	0.832	1
P	0	0	–

Abbreviation: PHEEM, Postgraduate Hospital Educational Environment Measure

TABLE 5. Differences Between Domain Scores of the Questionnaire and Demographic Characteristics of the Participants (P Values)

Domains/ variables	Frequency (n)	Mean±SD		
		Role autonomy	Teaching	Social support
Sex				
Men	136	2.84±0.55	2.99±0.68	2.83±0.69
Women	104	2.92±0.50	3.04±0.55	2.90±0.56
t		−1.106	−0.689	−0.851
P		.270	.492	.396
Grade level				
1st	88	2.83±0.57	2.98±0.68	2.75±0.70
2nd	69	2.83±0.50	2.95±0.58	2.88±0.56
3rd	83	2.96±0.51	3.10±0.61	2.95±0.61
F		1.630	1.315	2.103
P		.198	.271	.124
Type of training				
RSTM	169	2.87±0.55	3.03±0.63	2.84±0.65
CS	58	2.89±0.50	3.01±0.64	2.91±0.62
PMS	11	2.75±0.43	2.68±0.56	2.78±0.53
ASS	2	3.00±0.20	3.30±0.42	2.95±0.19
F		0.255	1.175	0.228
P		.858	.320	.877
Training hospital				
Heyuan People's Hospital	64	2.60±0.52	2.76±0.66	2.51±0.65
The Affiliated Hospital of Guangdong Medical University	44	2.93±0.53	3.13±0.61	2.98±0.54
Jieyang People's Hospital	47	2.98±0.52	3.10±0.54	2.97±0.63
The Third Affiliated Hospital of Southern Medical University	29	2.92±0.43	3.00±0.55	2.93±0.51
The Fifth Affiliated Hospital of Southern Medical University	22	3.04±0.46	3.12±0.58	2.95±0.62
Yuebei People's Hospital	34	2.99±0.52	3.11±0.69	3.07±0.63
F		5.165	3.073	5.868
P		0*	.010*	0*

*$P<.05$

Abbreviations: RSTM, Residents of Social Standardized Training for Medical Practitioners; CS, Commissioned Students; PMS, Professional Master Students; ASS, Advanced Study Students; SD, standard deviation

care system. While international literature has explored the impact of specialty, institutional affiliation, and supervisory relationships on PHEEM outcomes,[14,16,26,29–32] a paucity of research applies the Chinese version of the instrument to capture these dynamics in local settings—highlighting a need for further investigation. Furthermore, our findings demonstrated that senior residents reported significantly higher PHEEM scores than their junior counterparts. This observation is consistent with previous studies suggesting that senior trainees, having accrued more clinical exposure and adaptive strategies, tend to appraise their training environments more favorably.[16–18] In contrast, junior residents—often navigating unfamiliar systems and expectations—may focus more acutely on structural or interpersonal challenges. Future studies should examine the underlying factors driving perceptual differences between training levels, such as cognitive adaptation, exposure to feedback, and evolving expectations over the course of residency.

Study Strengths and Limitations

The limitations of this study must be acknowledged, particularly the cross-sectional design. The results regarding perceptions of the educational environment may not be widely applicable to different time periods or settings outside the context of this study. Because data were collected from hospitals within Guangdong Province, the representativeness of our findings in reflecting the teaching environments of postgraduate training bases for general practitioners in other provinces of China may be limited.

The PHEEM tool is based on the subjective perceptions of residents at specific times and locations and therefore cannot be considered an objective reality. Recall bias also may occur when asking about past events. To minimize this bias, the PHEEM scale inquires about recent events, which are easier for participants to remember. This study did not assess all factors that could influence residents' mental health, such as potential psychiatric or physical disorders, family dysfunction, or other aspects related to mental well-being.

The strengths of this study include high participation rates, the use of anonymous surveys, and a reduction of potential response bias, which enhances the methodological rigor of the study. Participants did not need to worry about identity leakage, enabling them to provide unbiased feedback without institutional influence. Additionally, the questionnaire included an open-ended, editable text box at the end, providing a platform for participants to express concerns or issues not covered by the structured framework of the questionnaire. This innovative feature not only increased participant engagement and autonomy but also facilitated the collection of qualitative feedback, offering valuable insights for future improvements and adjustments to the questionnaire.

CONCLUSIONS

In conclusion, this study provides empirical support for the use of the Chinese version of the PHEEM scale in evaluating the medical education environment for general practice residents in China. It confirms the reliability and validity of the tool in assessing clinical teaching environments. For future research, we recommend conducting multicenter, large-scale studies to further explore the differences in educational environments across regions and specialties, with a particular focus on social support and residents' mental health. This research will help optimize the learning environment for residents and provide stronger support for the development of high-quality general practitioners.

AUTHOR CONTRIBUTIONS

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