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Evaluation of the Postgraduate Learning Environment in Tunisian University Hospitals Using an Adapted French Version of the PHEEM Questionnaire

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Abstract

Background

The clinical learning environment plays a fundamental role in the professional development and well-being of medical residents. In Tunisia, there has been a lack of validated tools to assess this environment in a structured and consistent manner. This study aims to evaluate the perceptions of residents regarding their training environment using an adapted French version of the Postgraduate Hospital Educational Environment Measure (PHEEM).

Methods

A descriptive cross-sectional study was carried out between June and December 2024 in the faculty of medicine of Tunis and multiple Tunisian teaching hospitals. Residents from various specialties and all postgraduate years were invited to complete the PHEEM questionnaire, culturally adapted by modifying two items. Internal consistency was assessed using Cronbach's alpha, and principal component analysis (PCA) was used to explore the factorial structure.

Results

A total of 400 residents participated in the study, of whom 372 completed the full questionnaire and were included in the final analysis. The overall Cronbach's alpha was 0.922, indicating excellent internal consistency. PCA identified nine components with eigenvalues > 1, explaining 63.4% of total variance. The first three components aligned with the original domains (role autonomy, teaching, and social support). The mean overall PHEEM score was 127/200, interpreted as "more positive than negative". Surgical residents reported significantly lower scores than those in medical and intensive care specialties ($p < 0.001$).

Conclusions

This study supports the construct validity and internal consistency of an adapted French version of the PHEEM questionnaire for use in Tunisia. It also provides the first national insight into residents' perceptions of their learning environment, highlighting specific areas for improvement; particularly in surgical specialties. These findings offer a valuable baseline for future reforms in postgraduate medical education in resource-limited settings.

Practice points

- Residency training in Tunisia faces specific challenges, including high workloads, infrastructure issues, and resource allocation.

- To reflect Tunisian context, two items were modified in the PHEEM with excellent internal consistency.
- Teaching was "more positive than negative". Social Support received a lower score.
- Surgical residents reported significantly lower scores.
- These findings provide a baseline for educational reforms and quality enhancement initiatives.

Background

The clinical learning environment is fundamental in influencing the professional growth, well-being, and academic achievement of postgraduate medical trainees. During residency, doctors not only develop clinical knowledge and technical skills, but also learn through their day-to-day interactions with mentors, colleagues, and the broader healthcare system. A nurturing and well-organized educational setting fosters motivation, helps shape professional identity, and enhances the quality of patient care. In contrast, a negative or chaotic environment can contribute to burnout, lack of engagement, and diminished performance among residents.

With the increasing complexity of postgraduate medical education, the demand for reliable tools to systematically assess the learning environment has become more important than ever. The Postgraduate Hospital Educational Environment Measure (PHEEM), developed by Roff and colleagues in 2005, is among the most widely adopted instruments for this purpose [1].

Studies from Europe, Asia, and the Middle East have used the PHEEM to identify strengths and weaknesses in medical training programs, promote institutional reforms, and monitor the impact of curriculum changes [2–8]. Despite this wide adoption, there is a lack of published data from North Africa, and particularly from Tunisia, where postgraduate training systems face specific challenges related to workload, infrastructure, supervision, and resource allocation.

Tunisia’s health system, like many in the region, is undergoing significant transformation, and residency training remains a critical component of healthcare delivery. However, structured feedback from residents about their educational environment is often limited or informal. Implementing a validated tool like the PHEEM could provide valuable insights for policymakers, program directors, and academic institutions aiming to improve the quality of medical education in the country.

The main objective of this study was to assess the postgraduate medical education environment in Tunisian teaching hospitals.

Methods

This was a descriptive cross-sectional study conducted to assess the perceptions of residents regarding their postgraduate educational environment in public teaching hospitals in Tunisia. Data collection was carried out in person at the Faculty of Medicine of Tunis and various hospitals between June and

December 2024. Eligible participants were residents currently enrolled in a postgraduate training program. Participants from all years of postgraduate residency were included to provide a representative snapshot of the country's medical resident population. Physicians who were not residents, residents living outside Tunisia, or those who did not consent were not included. Questionnaires were excluded if consent was withdrawn or responses were incomplete. The minimum sample size was calculated based on the results of a previous study conducted among Moroccan medical residents, in which 69.8% of participants rated their clinical learning environment as positive or excellent using the PHEEM questionnaire [3]. The following formula was applied: $n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$. Using a 95% confidence level and a 5% margin of error, the minimum required sample size was estimated at 324 residents.

The data collection instrument was the validated French version of the Postgraduate Hospital Educational Environment Measure (PHEEM) questionnaire [9]. Consisting of 40 items, the PHEEM questionnaire evaluates residents' perceptions across three main areas: role autonomy, quality of teaching, and social support. This tool comprises 40 items scored on a five-point Likert scale and evaluates three domains: perceptions of role autonomy (14 items), teaching (15 items), and social support (11 items). To enhance cultural and contextual relevance, two items were adapted to align with the Tunisian postgraduate training context **(Appendix)**. Specifically, item 1 ("I have an employment contract that clearly specifies my working hours") was replaced by "Working hours are clearly explained by my clinical supervisors," reflecting the absence of formal employment contracts for residents in Tunisia. Likewise, item 7 ("There is racism in this post") was modified to "There is regionalism in this post," given the minimal representation of foreign residents and the more frequently reported perception of regionalism among trainees. Four negatively worded items (Q7, Q8, Q11, and Q13) were reverse coded prior to analysis to ensure consistency of scoring. In addition to the core PHEEM items, the questionnaire collected demographic and epidemiological information, including participants' age, gender, specialty, marital status, year of residency, and current training hospital.

Residents were invited to participate, provided with detailed information about the study, and asked to give written informed consent. Questionnaires were completed anonymously on site to maximize response accuracy and completeness **(Appendix)**.

Statistical analyses were performed using JAMOVI software. Internal consistency of the questionnaire and its subscales was assessed using Cronbach's alpha. Values above 0.70 were considered acceptable. To explore the factorial structure of the French version of the PHEEM questionnaire in the Tunisian context, a principal component analysis (PCA) with Varimax rotation was performed on all 40 items. The analysis followed Kaiser's criterion, retaining components with eigenvalues greater than 1. A scree plot was also used to visually assess the optimal number of factors. Descriptive statistics were used to characterize the study population. Categorical variables were reported as frequencies and percentages. Continuous variables were summarized as means with standard deviations for normally distributed data and as medians with interquartile ranges when distributions were skewed. Subscale

PHEEM scores were categorized into four interpretative ranges: very poor, plenty of problems, more positive than negative, and excellent. Group comparisons were conducted using independent samples t-tests for binary variables and one-way ANOVA for variables with more than two categories. A p-value of less than 0.05 was considered statistically significant.

Results

Participant demographics

A total of 400 residents completed the questionnaire. Of whom, 28 responses were excluded due to incomplete data, resulting in 372 fully completed questionnaires included in the final analysis. Of these, 202 (54.3%) were women and 170 (45.7%) were men. The highest responses came from first-year residents (30.4%). Figure 1 presents participants' distribution by their year of residency. Most residents reported being single (n = 226; 60.8%), with 89 residents (23.9%) indicating they were in a relationship and 56 (15.1%) identifying as married. One participant (0.3%) reported being widowed.

Residents were in medical fields like internal medicine, pediatrics, and other non-surgical areas in 51.6% of cases (n = 192). Surgical specialties were the next largest group (138 residents, 37.1%). The smallest group included those in intensive care (42 residents, 11.3%), such as emergency medicine, anesthesiology, and medical reanimation.

Internal consistency

The overall Cronbach's alpha for the 40-item scale was 0.922, indicating good reliability. Subscale alphas were 0.771 for "Role Autonomy", 0.881 for "Teaching" and 0.698 for "Social Support".

Factor analysis

Principal component analysis (PCA) with Varimax rotation was carried out on responses to all 40 items of the French version of the PHEEM questionnaire, adapted for use in the Tunisian postgraduate training context. A total of nine components had eigenvalues greater than 1, explaining 63.4% of the total variance. The first three components accounted for 30.5% of the variance, supporting the presence of three dominant latent dimensions. The scree plot showed a marked inflexion after the third factor, further supporting a three-factor solution consistent with the original structure of the PHEEM instrument (Fig. 2).

Descriptive overview of PHEEM scores

When looking at the overall results, the average PHEEM score across all participants was 127 out of a possible 200, with a standard deviation of 23. The individual scores ranged from 62 to 193. Based on the

adapted PHEEM interpretation categories. Residents felt that their educational environment was “More positive than negative” in 57.3% of cases. Figure 3 illustrates the distribution of respondents according to the interpretative categories of the PHEEM questionnaire.

When looking at the results for the different parts of the PHEEM questionnaire, the area that received the highest average score was the “Perception of Teaching” subscale. This part had an average score of 47.8 with a standard deviation of 9.17, and individual scores ranged from 21 to 71. The “Role Autonomy” subscale, had a slightly lower average score of 44.3 with a standard deviation of 8.51, and scores in this area ranged from 22 to 70. However, The “Social Support” subscale had the lowest average score among the three areas measured, with a mean of 35.1 and a standard deviation of 7.46, and scores ranging from 13 to 55. Figure 4 Box plot illustrates the distribution of overall PHEEM scores across different specialties.

Comparative analysis

Table 1 presents the association between residents’ characteristics and their total PHEEM scores. Surgical residents had significantly lower PHEEM scores than both medical residents ($p < 0.001$) and intensive care residents ($p = 0.027$). On the other hand, there was no significant difference between the scores of medical and intensive care residents, as the p-value for this comparison was 1.

Table 1
Relationship between residents’ characteristics and the total PHEEM score

Residents' characteristics	PHEEM score mean	Standard deviation	p
Gender			
Male	129	25.2	0.877
Female	127	21.1	
Year of residency			
1	129	19.2	
2	125	22.3	
3	126	27.2	0.509
4	130	22.5	
5	125	25.3	
Specialty			
Surgical	123	24.9	
Medical	131	21.6	< 0.001
Intensive care	134	18.4	

Discussion

To our knowledge, this is the first study conducted in Tunisia to formally assess medical residents' perceptions of their clinical learning environment using a validated instrument. This study provides a first insight into the clinical learning environment perceived by medical residents across university hospitals in Tunisia, using an adapted version of the French-language Postgraduate Hospital Educational Environment Measure (PHEEM). It was validated in numerous countries, translated into several languages, and has consistently demonstrated strong reliability and cross-cultural relevance [10, 11]. The overall mean score of 127 out of 200 suggested that residents viewed their training environment as "more positive than negative" consistent with findings from similar low-resource settings [3].

When stratifying results by specialty type, the three categories surveyed in our study—medical, surgical, and intensive care—each yielded median PHEEM scores that fell within the "more positive than negative" interpretive range. This contrasts with the findings of the 2020 Moroccan study, in which only medical specialties, pediatrics, laboratory medicine, and anesthesiology reached this category, while surgical specialties and obstetrics-gynecology were classified in the "plenty of problems" range [3].

The internal consistency of the adapted French PHEEM version used in this study was excellent, with a Cronbach's alpha of 0.922 for the full scale. This value exceeds the widely accepted threshold of 0.70 and is in line with previous validation studies: 0.91 in Morocco, 0.933 in Greece, 0.892 in Saudi Arabia and 0.899 in Brazil [2, 3, 12, 13]. Reliability at the subscale level was also satisfactory, with the "Teaching" (0.881) and "Role Autonomy" (0.771) domains showing particularly strong internal consistency. In contrast, the Cronbach's alpha for the "Social Support" subscale was 0.698, indicating borderline internal consistency. Similar findings have been reported in previous studies, suggesting that this domain may be more context-dependent and potentially influenced by cultural or institutional factors [3, 12] .

To better reflect the realities of postgraduate training in Tunisia, two items from the original French version were modified. Despite these adaptations (one concerning employment contracts and the other addressing perceptions of discrimination) the factorial structure remained coherent. The principal component analysis (PCA) of the adapted French version of the PHEEM questionnaire in our study revealed nine components with eigenvalues greater than 1, collectively explaining 63.4% of the total variance. The first three components alone accounted for 30.5% of the variance, aligning with the original conceptual framework of PHEEM, which includes the domains of "Role Autonomy", "Teaching", and "Social Support". This structure is consistent with findings from previous validation studies. For instance, the Moroccan study with the French PHEEM version also supported a multidimensional structure and emphasized the relevance of the instrument within the North African context [3]. Likewise, a study using the PHEEM in intensive care medicine identified three main factors: the quality of the teacher, learning in a safe environment, and overall wellbeing ("happiness index") [5]. These findings further support the ability of the instrument to capture multiple dimensions of the educational climate, even in complex clinical settings.

However, other studies have challenged the original three-domain model. For instance, Boor et al., in a Dutch study, reported that the PHEEM may better reflect a unidimensional construct, suggesting that the instrument predominantly captures a single overarching concept of educational quality, rather than distinct subdomains[14]. Similarly, a validation study conducted in Greece involving 731 residents also supported a unidimensional structure [2]. A study conducted in Chile during clinical clerkships yielded similar results, identifying a dominant dimension that encapsulated the overall perception of the educational environment [15]. A Brazilian study also identified “quality of instruction” as the main factor predicting academic performance [13]. These findings underscore the necessity of local validation, as the factorial configuration of PHEEM may vary across cultural and institutional settings.

Consistent with findings from previous studies conducted in Morocco and Saudi Arabia, our study revealed significantly lower PHEEM scores among surgical residents compared to those in medical and critical care specialties. In the Moroccan validation of the French PHEEM, surgical and obstetrics-gynecology residents reported learning environments classified as “plenty of problems,” in contrast to more favorable perceptions among other disciplines [3]. Similarly, Algaidi et al. observed that surgical interns in Saudi Arabia had markedly lower scores, reflecting a more challenging educational atmosphere [4]. These results may be attributed to the inherently hierarchical nature of surgical training, limited time for supervision due to high workloads, and reduced opportunities for constructive feedback or psychological support.

This study offers a comprehensive assessment of the clinical learning environment across various specialties and institutions in Tunisia. The cultural adaptation of two questionnaire items enhanced contextual relevance while maintaining structural validity. Nevertheless, the cross-sectional design limits the ability to assess changes over time. Longitudinal research is warranted to evaluate the responsiveness of the PHEEM tool to future educational reforms.

Conclusions

This first study assessed the clinical learning environment of medical residents in Tunisia. The overall mean score of 127 out of 200 suggested that residents viewed their training environment as “more positive than negative”. Surgical residents reported significantly lower scores than those in medical and intensive care specialties ($p < 0.001$).

This study supports the construct validity and internal consistency of an adapted French version of the PHEEM questionnaire in the Tunisian postgraduate training context. Although two items were culturally adapted to better reflect the Tunisian context, the overall factorial structure remained stable, supporting the robustness and relevance of the instrument. This study was particularly relevant in a developing country context, where training conditions are often challenged by heavy workloads and limited resources. It offers essential baseline data to support educational reform and quality enhancement initiatives.

Abbreviations

PCA
principal component analysis
PHEEM
Postgraduate Hospital Educational Environment Measure

Declarations

Ethics approval and consent to participate

All participants provided signed informed consent before participating in this study. Ethical approval was granted by the “Comité consultatif de bioéthique de la faculté de médecine de Tunis” in the 5th of June, 2024 (N°: CE-FMT/2024/03/ISA/VI).

The study was conducted in accordance with the **Declaration of Helsinki**

Consent publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

I.B.S: Study design, Statistical analysis, Manuscript writing. M.A: Data acquisition, Statistical analysis, Manuscript writing. A.M: Study design. A.B.S: Statistical Analysis. S.M.: Manuscript review and critical revision. I.M: Manuscript review and critical revision. T.B.D: Manuscript review and critical revision. All authors : Manuscript approval, accountable for the work.

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only for linguistic improvements, and all scientific content, interpretations, and conclusions remain the entire responsibility of the authors.

Availability of data and materials

Authors declare sharing data if needed

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Figures

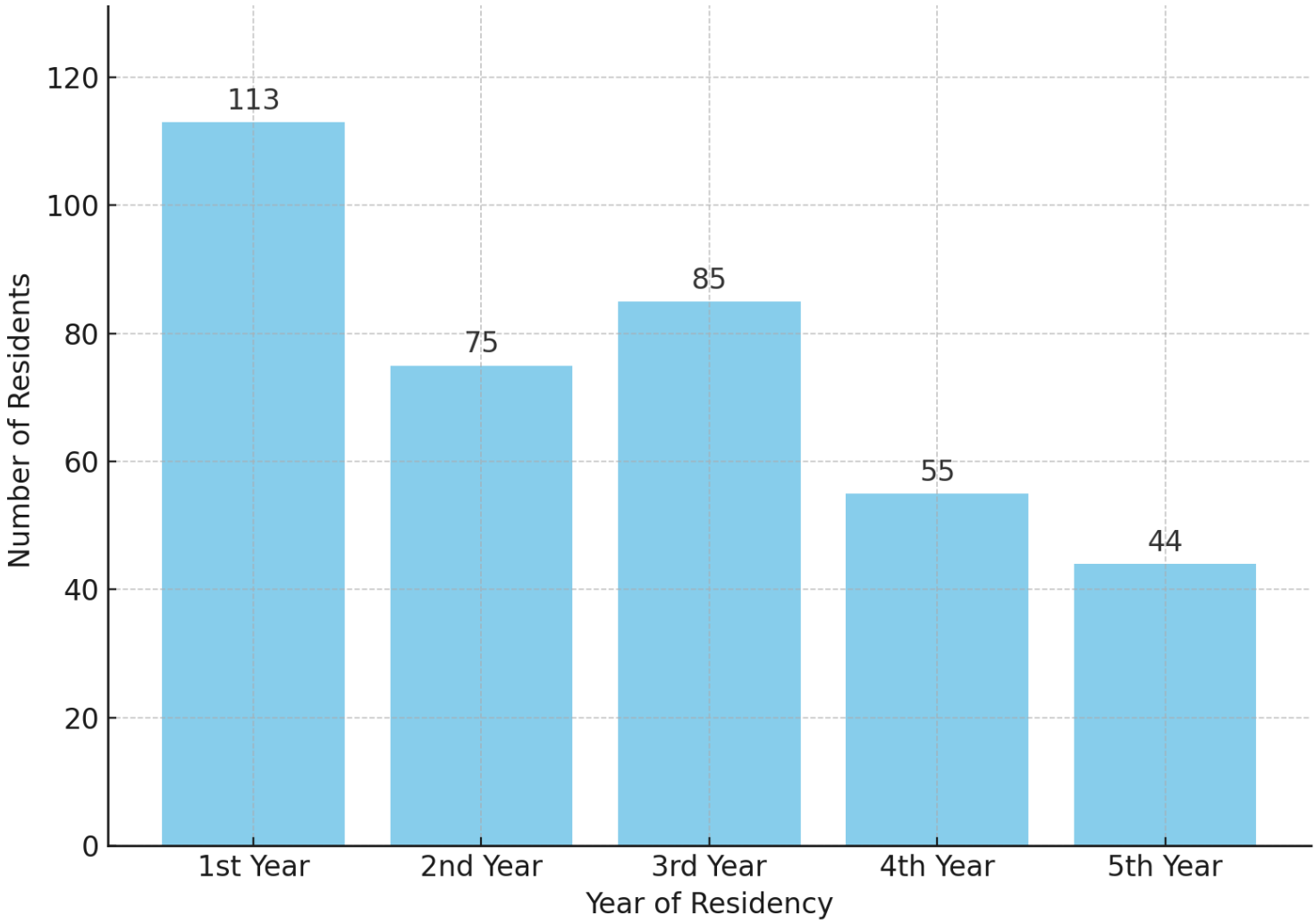


Figure 1

Distribution of residents according to year of residency

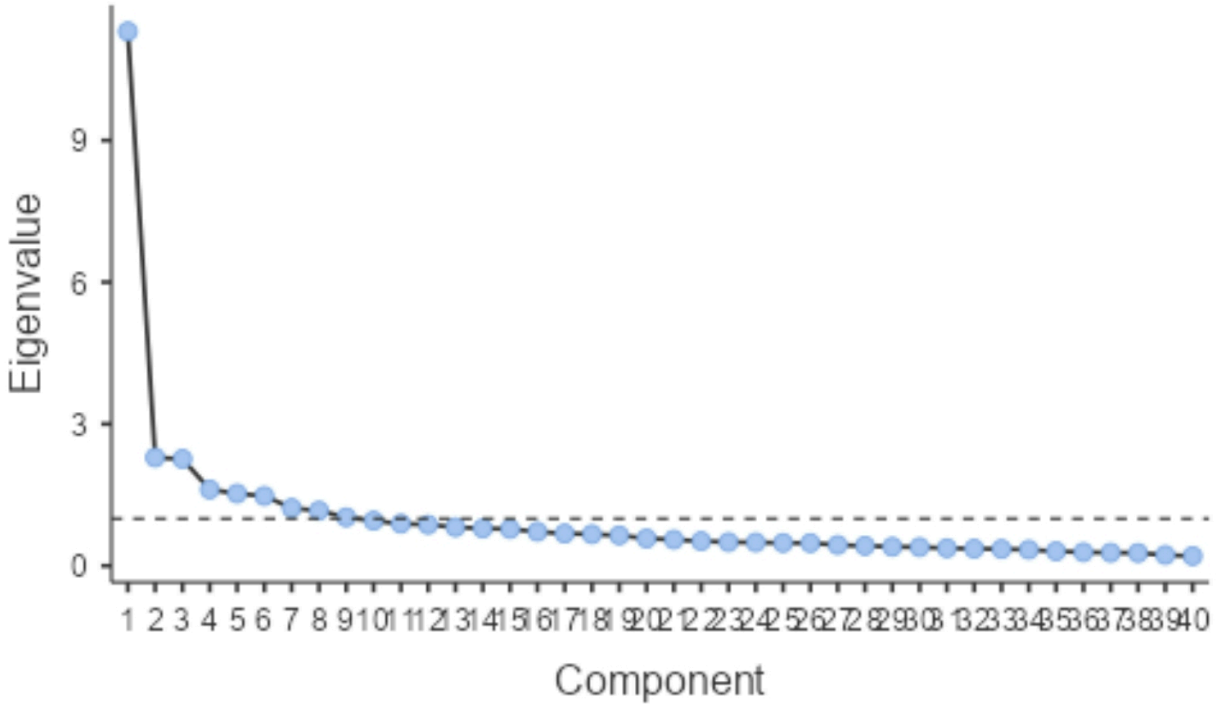


Figure 2

Scree plot of eigenvalues from principal component analysis of the 40-item PHEEM questionnaire

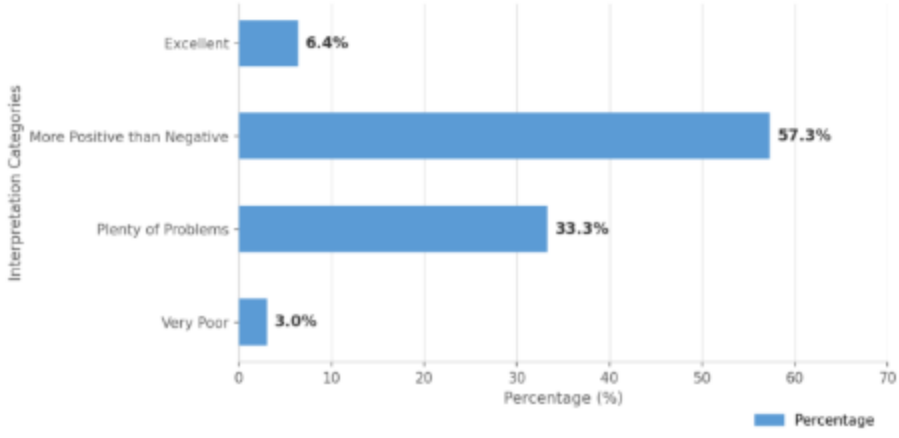


Figure 3

PHEEM interpretation categories distribution

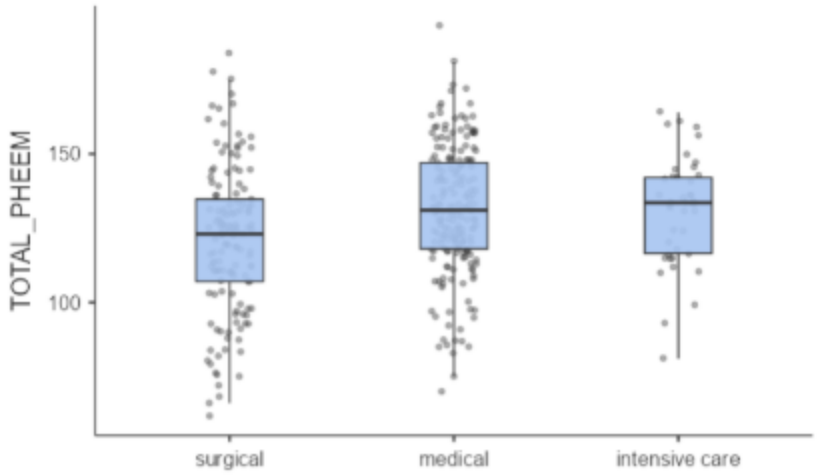


Figure 4

Box plot of overall PHEEM scores by specialty

Supplementary Files

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- BMCPHEEMquestionnaireENversion.docx