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Evaluating the educational environment in a Singaporean residency programme: can we help reduce burnout rates?

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ABSTRACT

INTRODUCTION: The educational environment (EE) reflects the quality of a residency programme and is associated with burnout. Studying the EE allows for interventions to target specific weaknesses. We aim to measure the educational environment of a Singaporean Internal Medicine Residency Programme, compare the perceptions between genders, residency grades and work experience, and identify specific areas of weaknesses for intervention in hopes of reducing residency burnout rates in Singapore.

METHODS: This study took place between October and December 2017. We adopted a mixed methods approach, quantitatively using the Postgraduate Hospital Educational Environment Measure (PHEEM), and qualitative exploration using semi-structured focus group discussion.

RESULTS: A total of 136 out of 153 (88.9%) residents responded. The total PHEEM scores (112.23 ± 16.7), along with the scores for all three subscales, were higher than those of other institutions. There were no differences in overall PHEEM and subscale scores between genders, residency grades or levels of work experience. However, there were differences for individual questions, which were explored in the focus group discussion. Senior residents juggling heavier workload distribution, responsibilities and examinations appeared to be most prone to burnout. We identified three recurring themes that contributed to a poor EE in our programme: excessive workload, poor faculty relationships and differing unmet needs.

CONCLUSION: Although our programme had a good EE, there were also areas of weaknesses revealed by specific questions, possibly contributing to burnout. We hope to implement interventions to these areas and subsequently assess for longitudinal changes in EE and burnout rates.

Keywords: burnout, educational environment, learning climate, PHEEM, Singapore

INTRODUCTION

Measurement of the educational environment (EE) is an indication of the quality of a curriculum.[1] Recognition of the importance of EE has led the Accreditation Council for Graduate Medical Education (ACGME) to implement the Clinical Learning Environment Review (CLER) programme as part of its next accreditation system.[2] There is evidence that EE influences student career choices[3] and achievements,[1] and likely has a greater impact on postgraduates due to the complex relationships between fellow doctors and the constant tensions between service and training.[4] A positive EE has also been associated with better workplace learning,[5] better examination scores[6] and more career satisfaction.[7,8] The EE has been shown to influence burnout rates,[9,10] and this association holds true even after controlling for specialty, level of training, gender and age.[11] This is of interest to us, as a recent study[12] has shown that Singaporean residents have higher burnout rates compared to their Western counterparts.

Therefore, the aim of our study was to measure the EE of a Singaporean Internal Medicine Residency Programme, compare the perceptions among genders, residency grades and levels of working experience and, in so doing, identify specific areas of weaknesses that may potentially contribute to high burnout rates.

METHODS

Singapore engaged ACGMEI-International (ACGME-I) to manage the accreditation of its postgraduate training in 2009, and was the first country to successfully receive ACGME-I accreditation in 2010. There are three health clusters in Singapore, National University Health System, National Healthcare Group and Singapore Healthcare Services (SingHealth), each with its own residency programmes. Our programme, SingHealth Internal Medicine is the largest

residency programme, consisting of around 150 residents spread across three years of training. Training takes place at three main sites: Singapore General Hospital, Changi General Hospital and National Neuroscience Institute. The programme admits both undergraduates directly from medical school and postgraduate doctors who have already joined the workforce.

The current study was exempted from formal ethical board review, as no patients were included; there was also no risk to participants and anonymity was maintained. We used a mixed method approach, including quantitative measurement using the Postgraduate Hospital Educational Environment Measure (PHEEM)[13] and qualitative exploration of PHEEM data using focus group discussions.

The PHEEM[13] consists of 40 items that are divided into three subscales: perceptions of role autonomy; teaching; and social support. It has been administered to different sample groups and from various specialties, demonstrating almost similar reliability coefficients. Therefore, it was deemed the most suitable instrument for measuring EE in postgraduate medical education due to its content validity, high reliability and ability to be used in different settings.[14]

Although we made slight modifications to the PHEEM, as some questions were inappropriate, the changes were unlikely to alter the resident's perspective on these questions. Examples of changes included Q11 where 'bleeped' was replaced with 'received phone calls' and Q17 where 'new deal' was replaced with 'ACGME requirements'. We administered the PHEEM online to 153 active IM residents between October 2017 and December 2017. We included questions on gender, work experience, residency grade and training sites, and a free-text section where residents can write their narrative feedback. To maximise response rate, the residents received up to three reminders. Participation was voluntary and anonymity was assured.

A semi-structured focus group session was conducted to supplement the PHEEM results. Purposeful sampling of residents (five females; two first- year, three second-year, three third-year residents) was done to ensure heterogeneity of participants for different perspectives, and a group size of eight was chosen, as it has been previously suggested to be the optimal number.[15] The PHEEM results were presented to the group and used to influence the question route. The main theme was to understand the factors involved in poor perception of the EE contributing to burnout. The session lasted 75 minutes and was conducted by the first author (AO). Consent was obtained from the participants for audio recording and verbatim transcribing of interviews.

A summary of our analysis was made available to the interviewees to check the accuracy of the summary. This 'member checking' did not yield any revisions. Two authors (AO and WF) used an open coding strategy to reduce the data and uncover the basic concepts. Similar concepts were grouped together to form themes. Differences in concepts were resolved through discussion between the two authors. We adopted an inductive approach, using quantitative data from the PHEEM analysis, open-ended narrative feedback from questionnaires and focus group opinions to triangulate concepts and draw conclusions.

We analysed our data using IBM SPSS Statistics version 23 (IBM, Armonk, NY, USA). Data was presented as mean and standard deviation for quantitative data, and proportions for categorical data. Unpaired Student's *t*-test was used for parametric quantitative data comparisons and Wilcoxon signed-rank test for nonparametric quantitative data. ANOVA with post-hoc Bonferonni corrections was used to analyse comparisons between multiple groups. Differences were considered significant if $p < 0.05$. Reliability analysis was performed using Cronbach's alpha coefficient.

RESULTS

A total of 136 out of the 153 (88.9%) residents responded. The characteristics of the respondents

are shown in Table I. Cronbach's alpha was 0.95, and when analysed to exclude each question,

no significant improvement in the score was obtained, reflecting high internal reliability and no

irrelevant questions.

Table I. Characteristics of the study population (n = 136).

Characteristic	No. (%)
Gender	
Male	70 (51.5)
Female	66 (48.5)
Residency year	
R1	42 (30.9)
R2	51 (37.5)
R3	43 (31.6)
Work experience	
PGY1	18 (13.2)
PGY2	25 (18.4)
PGY3	28 (20.6)
PGY4	21 (15.4)
PGY5	13 (9.6)
> PGY5	31 (22.8)
Training site	
Singapore General Hospital	90 (66.2)
Changi General Hospital	41 (30.1)
National Neuroscience Institute	5 (3.7)

PGY: postgraduate year

Table II summarises the mean responses to each question. Our mean total PHEEM scores

(112.23 ± 16.71), along with the scores for all three subscales, were higher than those of other

institutions that have used the PHEEM (Table III). Based on the recommended scoring,[13] our

programme was deemed more positive than negative, with room for improvement. No resident

scored the EE as very poor, while 3 (2.2%) residents scored it as having plenty of problems, 97

(71.3%) as more positive than negative, and 36 (26.5%) as excellent.

Table II. Summary of PHEEM results.

Item	Questions	Mean	SD
1	I have been provided information about hours of work	2.78	0.73
2	My clinical teachers set clear expectations	2.78	0.65
3	I have protected educational time	2.51	0.89
4	I had an informative induction programme	2.76	0.71
5	I have been given an appropriate level of responsibility*	3.19	0.52
6	I have good clinical supervision*	3.15	0.51
7	There is racism*	3.22	0.80
8	I have to perform inappropriate tasks	2.98	0.82
9	There is an informative Internal Medicine residency handbook	2.49	0.82
10	My clinical teachers have good communication skills*	3.07	0.49
11	I receive phone calls inappropriately	2.10	1.02
12	I am able to participate actively in educational events	2.78	0.77
13	There is sex discrimination*	3.37	0.66
14	There are clear clinical protocols	2.82	0.69
15	My clinical teachers are enthusiastic*	3.07	0.57
16	I have good collaboration with other doctors in my grade*	3.20	0.51
17	My working hours conform to ACGME requirements	2.13	1.11
18	I have the opportunity to provide continuity of care	2.84	0.61
19	I have suitable access to careers advice	2.76	0.78
20	This hospital has good quality accommodation when on call	2.42	1.01
21	There is access to an educational programme relevant to my needs	2.88	0.66
22	I get regular feedback from seniors	2.79	0.68
23	My clinical teachers are well organised	2.94	0.48
24	I feel physically safe within the hospital environment*	3.18	0.63
25	There is a no-blame culture	2.42	0.90
26	There are adequate eating facilities when I am on call	2.23	1.09
27	I have enough clinical learning opportunities for my needs	2.97	0.56
28	My clinical teachers have good teaching skills	2.99	0.51
29	I feel part of a team working here*	3.18	0.54
30	I have opportunities to acquire the appropriate practical procedures for my grade	2.95	0.60
31	My clinical teachers are accessible*	3.07	0.47
32	My workload in this job is fine	2.54	0.93
33	Senior staff utilise learning opportunities effectively	2.90	0.53
34	The training in this post makes me feel ready to be a senior resident	2.69	0.68
35	My clinical teachers have good mentoring skills	2.92	0.60
36	I get a lot of enjoyment out of my present job	2.79	0.82
37	My clinical teachers encourage me to be an independent learner*	3.04	0.49
38	There are good counselling opportunities for residents who fail to complete their training satisfactorily	2.43	0.69

39	The clinical teachers provide me with good feedback on my strengths and weaknesses	2.79	0.63
40	My clinical teachers promote an atmosphere of mutual respect	3.05	0.51
Mean total PHEEM score		112.23	16.71
Perception of role autonomy		38.50	6.18
Perception of teaching		42.79	6.49
Perception of social support		30.93	5.07

Questions with high mean scores > 3 (strong points of educational environment) ACGME: Accreditation Council for Graduate Medical Education; PHEEM: Postgraduate Hospital Educational Environment Measure; SD: standard deviation

Table III. Comparison of PHEEM scores.

Country	Specialty	No. of responders	Total PHEEM	Autonomy	Teaching	Social
Singapore	Internal Medicine	136	112.23	38.50	42.79	30.93
Australia[27]	Junior doctors	429	110.0	NA	NA	NA
Singapore[25]	Psychiatry	60	109.3	NA	NA	NA
United Kingdom[26]	Intensive care	134	103.5	35.7	38.8	28.43
Saudi Arabia[35]	Paediatrics	104	100.2	34.91	38.89	26.38
Saudi Arabia[24]	Mixed residents	193	89.2	29.6	33.5	22.5
Ireland[32]	Junior doctors	61	82.9	NA	NA	NA
Saudi Arabia[28]	Family Medicine	91	67.1	24.2	17.9	28.4
Japan[6]	Resident physicians	206	57.6	NA	NA	NA

PHEEM: Postgraduate Hospital Educational Environment Measure

The lowest scoring items were: Q11, 'I receive phone calls inappropriately' (mean 2.10 ± 1.03); Q17, 'My working hours conform to ACGME requirements' (mean 2.13 ± 1.11); and Q26, 'There are adequate eating facilities when I am on call' (mean 2.23 ± 1.09).

There were no differences in overall PHEEM and subscale scores between genders (Appendix I, Supplementary Table I). However, female residents perceived less opportunities to acquire practical procedures ($p = 0.03$). There was also a trend for female residents to perceive that they had less clinical learning opportunities and to derive less enjoyment from their job, but these were not significant.

In terms of residency grades, there were no differences in overall PHEEM and subscale scores (Appendix I, Supplementary Table II). However, there were differences for individual questions. First-year residents (R1) were less clear about clinical protocols (p = 0.009), and perceived that there were less relevant educational programmes available (p = 0.013) and less feedback given by seniors (p = 0.014), and that their teachers were less organised (p = 0.02), less able to teach (p = 0.046) and ineffective at utilising learning opportunities (p = 0.028).

Similarly, although no differences were seen in overall PHEEM and subscale scores between the levels of work experience (Table IV), there were differences for individual questions. Residents who were in postgraduate year (PGY) 3–5 perceived their workload to be heavier (p = 0.03), although the very experienced (> PGY5) residents were less likely to have the same perception. PGY5 residents were more likely to perceive: poorer collaboration with other doctors (p = 0.04); their teachers to be less respectful (p = 0.032); and a blame culture (p = 0.05). Again, the very experienced residents (> PGY5) did not share the same perceptions.

Based on our analysis of the focus group discussion and free-text narrative feedback, we identified three recurring themes that contributed to poor EE in our programme. We illustrate these themes using specific quotations from the residents.

Excessive workload often resulted in a lack of protected educational time and frustration that, while being forced to log educational hours, they were often not able to attend these activities or were disrupted during attendance.

- Resident 7: *"Other hospitals have a lot of focused teaching for exams, they have afternoons off with dedicated teaching from 2–5. We don't have that."*

- Resident 2: *"Even though I physically attend, my mind is not here because I have a lot of work. So I go there just to sign my attendance, or else I get an angry email."*

- Resident 1: *"Daytime hours are difficult no matter how you say it is protected. Nobody respects the protected timing."*

Furthermore, the excessive workload and sometimes, the repetitive nature of the job for the more senior residents made them feel jaded and discouraged.

- Resident 7: *"As you work more, you get jaded…you feel whatever you are doing isn't recognised, not appreciated, and you feel like you are a cog in the system.…Many are just doing the bare minimum to survive, so that they can have a balanced life. So why am I trying so hard?"*

- Resident 5: *"Imagine you are PGY 8 or 10, and still doing discharge summaries, same as what House Officers are doing."*

Another recurring theme was the infrequent contact and poor relationship with residency supervisors and ward consultants, resulting in poor feedback.

- Resident 6: *"The mentors attached to your posting, I hardly talk to any…The mentor-mentee thing is just for show."*

- Resident 1: *"With every posting, you are supposed to have a supervisor. I've only met one such supervision … I only met my residency supervisor halfway into my residency. Some have never met their supervisors."*

Residents were often given grades below their expectations but how the grades are determined were not made clear to them, since there was minimal feedback.

- Resident 8: *"They tell you a feedback that is not timely, not specific and no ways to improve yourself."*

- Resident 6: *"It wasn't as good as I thought it would be…What did I do wrong?…I'm working my butt off…If you think I'm just average, at least say what else I can improve on."*

Residents with varying levels of experience had different perceptions and expectations of the environment. Junior residents were more critical of teaching programmes, while senior residents were more focused on efficient postgraduate exam preparations.

- Resident 3: *"The house officers probably think they have less access to educational programs when they compare it to medical school."*

- Resident 7: *"When you are R3, you are concerned about clearing exams. So you want focused and effective teaching…especially in a busy posting and your teaching opportunities don't help you to clear exams, it is an issue."*

A specific concern was the pressure on senior residents as they were receiving unfair workload distributions and responsibilities, along with pressure of examinations. Therefore, it was highlighted repeatedly that this group was likely to burnout.

- Resident 5: *"There isn't a culture of having to complete your exams by a certain time point in Australia…Here, that actually leads to high burnout rates in more senior residents. You have to juggle your work and after work, you stay late practicing for exams."*

- Resident 1: *"Junior doctors don't feel it because if you didn't know anything, you just escalated, and you shifted the responsibility from yourself to somebody else…So they don't feel the blame or responsibility."*

- Resident 3: *"There are three main things. Expectations, responsibilities and age. The more senior you are, the better your work must be. Your senior expects more from you and it is quite marked. Responsibilities also. There is consent taking, giving sedation which a PGY1 cannot do. Also, the senior residents also have research going, and the seniors also ask them to do more because they are more familiar with them. And with age, the mentality is that you have done it for so long, you are tired."*

DISCUSSION

In the largest residency programme in Singapore, we found that our EE was perceived by our residents as being more positive than negative, but with room for improvement. Compared to other institutions worldwide, we had the highest overall PHEEM score and the highest scores of all three subscales (Table III). Although overall PHEEM and subscale scores did not differ between gender, work experiences and residency grades, we found significantly different perceptions to specific questions within these groups. Our qualitative analysis also identified three recurring themes contributing to a poor EE, namely excessive workload, poor relationship with faculty and differing unmet needs. These three themes will likely form the basis of interventions to improve the EE.

One of the worrying yet unsurprising results of the PHEEM analysis was that two of the lowest scored items among residents were Q11 "I receive phone calls inappropriately" and Q17 "My working hours conform to ACGME requirements". Residents consider balance between work, training and personal needs to be conducive to a positive EE, and that service obligations are detrimental to their learning needs.[16] However, the reality is that residents often face tension between work and learning, and constant disruptions impact the resident's focus on learning, especially the senior residents juggling examination commitments. This is an impetus for programmes to discuss phone call protocols with nursing staff, work with individual departments to protect educational time and provide examination preparation resources. Other potential solutions include ensuring equal distributions of senior and junior residents among medical teams, or finding creative ways to incorporate educational activities into service obligations.

Schönrock-Adema highlighted that interaction and collaboration with others was important in determining the EE,[17] while Boor demonstrated that good supervisory strategies

contribute to a good EE.[16] In our focus group discussion, a recurring concern was that poor relationships with faculty were causing a poor EE, specifically inadequate supervisor contact and the minimal feedback given. This problem is not unique to our programme, as many institutions looking into EE also found limited access of residents to their supervisors.[18] Increasing educational time without increasing time spent on supervisor-resident contact still reduces the measured EE,[19] thus emphasising the importance of the supervisor-resident relationship. A systematic review[20] of EE interventions showed that faculty mentor programmes were highly regarded by students as a method of reducing burnout. These results reinforce the fact that residents yearn for appropriate supervision and feedback and, therefore, clinical educators need to constantly remind themselves of their other roles apart from transmitting knowledge.[21,22] Faculty development programmes need to focus on developing the faculty's pedagogical skills for delivering feedback and effective supervision, as well as consider novel ways of mentoring such as a small group-based mentoring model[23] or a faculty advisory programme[24] focusing on mentoring support.

There are conflicting results in the literature of PHEEM differences based on training levels. Some studies[25-27] showed that junior trainees have better perceptions of the EE, while others showed that senior trainees had better perceptions.[28-30] Perhaps the conflicting results are due to the rigidity of programmes that try to deliver the same educational activities to residents of varying levels; this is true of our programme, which admits both undergraduates and postgraduate doctors. Our PHEEM analysis showed that experienced residents were significantly more likely to have these perceptions: a heavier workload; poorer collaboration with other doctors; their teachers being less respectful; and a blame culture. Our focus group discussion affirmed these results and suggested that the more experienced residents are also the most likely

to experience burnout due to performance pressures from senior doctors and the need to juggle examinations. The focus group discussion also suggested that different residents may perceive the EE differently due to differing unmet learning needs. A senior resident may be burdened with excessive workload that is boring and repetitive along with heavier responsibilities, while a junior resident is concerned about assimilating medical and practical knowledge, and therefore more critical of teaching quality. This finding of differing unmet needs of residents were also reported in other studies looking at factors that facilitate residents' learning.[16,31,32] The implication of this is that we should consider creating flexible training programmes to empower residents to choose learning activities relevant to their stage of training or experience, or offer flexible rotation plans that expose residents to opportunities beyond clinical work (e.g. education or research).

There were some differences of responses in individual questions when we looked at gender and training sites. Most studies on PHEEM did not show differences between genders,[18] but it was noted that some studies revealed poorer scoring for questions pertaining to sexual discrimination.[27,33] Our focus group discussion suggested that this could be due to personality differences between genders, as females were less assertive in getting opportunities for procedures, but reassuringly, there was no sexual discrimination within the faculty. We found the main difference in training sites were organisational issues such as poor catering and accommodation, along with receiving calls inappropriately. This was mainly for residents in Singapore General Hospital, the busiest hospital in Singapore. Each training site has different infrastructures and service obligations, but to be holistic in the interventions applied to improve EE, such information has to be fed back to the relevant authorities.

Our response rate of 88.9% was high, providing adequate sampling of the EE in our programme. Quantitative analysis alone would not have identified many of our weaknesses, such as poor relationships with faculty. Using a mixed method analysis made our findings more robust and gave us more confidence in our conclusions. The qualitative data allowed us to explore ill-defined concepts that are not easily explained by quantitative data. However, there were several limitations to our study. First, we only analysed residents within a single health cluster, which may limit the generalisability of our data. Second, we sampled only eight residents in one focus group due to logistical reasons, and therefore, we are unlikely to have achieved data saturation; however, the purpose of our qualitative analysis was to explore findings in the PHEEM rather than draw conclusions solely via qualitative analysis. Third, the study was cross-sectional and hence, we could not establish causal relationships between factors. Finally, a single researcher, who was a programme faculty member, had conducted the focus group, which could have affected its course; however, this effect was reduced by the use of a directive moderating style.[15]

Despite our programme having the highest PHEEM scores available in the literature, a local study has reported that the burnout rates and empathy levels of Singaporean residents were lower than Western residents.[12] A possible reason for this phenomenon is that Singaporean residents are generally satisfied with their educational environments despite their struggle to cope at work. Another explanation could be our use of only a single instrument and thus, the domains measured in the PHEEM questionnaire may not necessarily illuminate the complex issue of burnout; this is a yet another limitation of the study. However, our own experience is that burnout is a real issue within our programme, as well as a major concern because of the consequences on patient outcomes and the residents themselves.[11] There is a hypothesis that burnout is rooted in issues that are related to the EE;[11] in support to this, a meta-analysis has

shown that organisation-directed approaches are more effective in reducing burnout compared to individual interventions, such as mindfulness training.[34]

In conclusion, the current study identified several weaknesses that contributed to the high burnout rates among our residents: excessive workload; poor relationships with faculty; and differing unmet learning needs. We hope to use this information to implement future interventions and subsequently repeat the measurement of the EE to assess longitudinal changes. In so doing, we endeavour to reduce our residency burnout rates.

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Table IV. Comparisons of PHEEM score between levels of work experience.

	PGY1 (n = 18)		PGY2 (n = 25)		PGY3 (n = 28)		PGY4 (n = 21)		PGY5 (n = 13)		> PGY5 (n = 31)		p-value
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Total PHEEM score	114.83	13.82	114.32	17.27	107.93	17.58	113.38	16.21	102.15	16.45	116.35	16.16	0.09
Perception of autonomy	38.89	5.77	39.44	5.94	36.89	6.25	39.00	6.35	34.85	6.00	40.16	6.01	0.09
Perception of teaching	43.25	5.36	43.29	6.80	40.82	6.91	43.10	5.99	39.85	7.40	44.81	5.92	0.12
Perception of social support	32.44	3.97	31.60	5.38	30.21	5.53	31.29	4.94	27.46	4.14	31.39	5.02	0.11
Q9. There is an informative IM residency handbook	2.72	0.75	2.68	0.69	2.64	0.83	2.24	0.63	2.00	0.82	2.42	0.96	0.05
Q16. I have good collaboration with other doctors in my grade	3.22	0.43	3.24	0.52	3.18	0.48	3.24	0.44	2.77	0.73	3.32	0.48	0.04
Q25. There is a no-blame culture	2.78	0.55	2.36	0.81	2.46	0.88	2.57	0.75	1.54	1.13	2.48	0.96	0.01
Q32. My workload in this job is fine	2.89	0.58	2.89	0.58	2.18	1.10	2.38	0.92	2.23	0.93	2.77	0.96	0.03
Q34. The training in this post makes me feel ready to be a senior resident	2.50	0.71	2.50	0.71	2.39	0.74	2.90	0.54	2.92	0.65	3.00	0.52	0.01
Q40. My clinical teachers promote an atmosphere of mutual respect	3.11	0.47	3.12	0.53	2.96	0.51	3.00	0.55	2.69	0.48	3.23	0.43	0.03

IM: Internal Medicine; PHEEM: Postgraduate Hospital Educational Environment Measure; SD: standard deviation

APPENDIX

Supplementary Table I. Comparisons of PHEEM between genders.

	Male (n = 70)		Female (n = 66)		p-value
	Mean	**SD**	**Mean**	**SD**	
Total PHEEM score	113.61	17.25	110.76	16.13	0.32
Perception of autonomy	38.94	6.39	38.03	5.95	0.39
Perception of teaching	43.39	6.63	42.17	6.31	0.28
Perception of social support	31.29	5.25	30.56	4.88	0.41
Q27. I have enough clinical learning opportunities for my needs	3.06	0.56	2.88	0.54	0.06
Q30. I have opportunities to acquire the appropriate practical procedures for my grade	3.06	0.59	2.83	0.60	0.03
Q36. I get a lot of enjoyment out of my present job	2.91	0.81	2.65	0.81	0.06

PHEEM: Postgraduate Hospital Educational Environment Measure; SD: standard deviation

Supplementary Table II. Comparisons of PHEEM between residency grades.

	R1 (n = 42)		R2 (n = 51)		R3 (n = 43)		p-value
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Total PHEEM score	110.00	15.20	115.53	15.83	110.49	18.78	0.20
Perception of autonomy	37.76	5.88	39.63	5.75	37.88	6.85	0.26
Perception of teaching	41.26	6.07	44.50	5.83	42.44	7.30	0.07
Perception of social support	30.98	4.51	31.55	5.17	30.16	5.47	0.42
Q8. I have to perform inappropriate tasks	3.05	0.80	3.18	0.65	2.67	0.94	0.01
Q14. There are clear clinical protocols	2.60	0.67	2.76	0.76	3.12	0.50	< 0.01
Q21. There is access to an educational programme relevant to my needs	2.69	0.75	3.08	0.44	2.81	0.73	0.01
Q22. I get regular feedback from seniors	2.57	0.70	2.98	0.62	2.77	0.68	0.01
Q23. My clinical teachers are well organised	2.81	0.55	3.08	0.39	2.91	0.61	0.02
Q28. My clinical teachers have good teaching skills	2.86	0.35	3.12	0.48	2.98	0.64	0.05
Q33. Senior staff utilise learning opportunities effectively	2.83	0.44	3.06	0.37	2.79	0.71	0.03
Q34. The training in this post makes me feel ready to be a senior resident	2.45	0.67	2.73	0.72	2.88	0.59	0.01

PHEEM: Postgraduate Hospital Educational Environment Measure; SD: standard deviation