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Burn-out and relationship with the learning environment among psychiatry residents: a longitudinal study

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ABSTRACT

Objectives Recent research suggests that burn-out is high and appears to be rooted in system-level factors including the local learning environment (LE). While most studies on this topic have been cross-sectional, our aim was to explore the relationship between burn-out and the LE over time within psychiatry residents. We hypothesised that burn-out is a significant predictor of learner perception of overall and all subdomains of LE within residents.

Design This was a repeated measures questionnaire study.

Setting We surveyed psychiatry residents in Singapore between January 2016 and December 2019.

Primary and secondary outcome measures The Oldenburg Burnout Inventory and the Postgraduate Hospital Education Environment Measure (PHEEM) were used to assess burn-out and resident perception of the LE, respectively. Linear mixed modelling was used to examine changes in PHEEM scores over time while taking into account burn-out status.

Participants Overall, 93 residents (response rate 89.4%) took part.

Results The average difference between initial PHEEM total scores for residents with and without burn-out was significant (p<0.001). Burn-out status was a significant predictor of lower overall and all subdomain PHEEM scores at baseline (all p<0.001). PHEEM Teaching scores showed a significant increase over time for all residents regardless of burn-out status (p<0.05). However, PHEEM Total, Role Autonomy, Social Support scores did not change significantly over time or change significantly between residents with or without burn-out.

Conclusions Perceptions of LE among psychiatry residents at baseline are inversely associated with burn-out status. That only the Teaching subdomain score increased over time could be accounted for by the fact that it is a more tangible and visible aspect of the LE compared with perceived role autonomy or social support subdomains. Our findings underscore the importance of attending to the well-being and improving the LE of our residents so as to optimise learning during training.

INTRODUCTION

To date, studies have revealed high burn-out rates within residents in training.[1] Although individual traits might contribute to the development of burn-out, organisation-directed

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ We adopted a longitudinal design which adds insight into how burn-out and perceptions of the learning environment change over time.
⇒ We used linear mixed modelling analyses to examine how the Postgraduate Hospital Education Environment Measure scores vary over time and were associated with burn-out.
⇒ This study was limited by the size of the National Psychiatry Residency programme in Singapore, although all eligible residents were invited to participate.
⇒ The focus on psychiatry residency programme may limit the generalisability of findings to other non-psychiatry residency programmes.

approaches appear to be more effective in reducing burn-out than individual interventions.[2] A recent commentary by Dyrbye *et al*[3] emphasised the need to look beyond the individual and address system-level factors. Only by doing so can educators 'optimise learning environments (LE) that prevent and reduce burn-out and foster professional well-being'.[4]

The LE is one such system-level factor.[3] There are data to suggest that residents' perceptions of the clinical LE can impact negatively on their learning outcomes,[5] mental well-being[6] and ability to connect effectively with patients.[7] Disengagement and cynicism stemming from burn-out within an unsupportive LE may make it difficult for learners to uphold and internalise professional values.[8]

Earlier studies examining the relationship between the LE and burn-out have largely been cross-sectional in nature.[6 9 10] Findings of burn-out resulting in career regret and suboptimal professional development are also reported in learners.[4] These studies suggest that learners' level of identification with their learning community in residency (fellow residents and faculty) and the values they espouse may therefore be adversely affected by burn-out. However, while these studies suggest that negative perceptions of the LE

are associated with burn-out,[6 10 11] little is known about how burn-out and learner's perceptions of the LE may change over time. This poses a problem for educators seeking to introduce and evaluate interventions for supporting residents. First, residents at different stages of their learning journey may require varying levels of support.[11] A longitudinal study would be able to provide a perspective of the learning trajectory and inter-relationship with burn-out. Second, the LE can be divided into the areas of role autonomy (RA), teaching and social support (SS). We chose LE as the main variable of interest as it allows us to examine the downstream effects of burn-out in residents. Poorer ratings in specific subdomains of LE as rated by residents experiencing burn-out would suggest areas for improvement within the residency's LE, which would in turn better support the residents in their learning.

To address this gap in the literature, we aimed to examine the relationship between burn-out and different aspects of the LE over time. We hypothesised that burn-out is a significant predictor of learner perception of all subdomains of LE. In particular, our group of interest is psychiatry residents. Burn-out rates in this population are high, ranging between 20% and 87% internationally in recent studies and reviews[1 12–16]—and this may impact their perception of the LE. Of note, our recent review found that burn-out among psychiatry residents was associated with specific demographic (such as younger age, non-parental status), training (such as junior years of training, a lack of or poorer perceived quality of clinical supervision, dissatisfaction with clinical faculty), work (such as long hours, inadequate rest, high workload) and personal learner factors (such as low self-efficacy, decreased empathic capacity, poor coping, reduced help-seeking from supervisors).[12] In addition, psychiatry residents also face unique stressors in the form of violent patients and patient suicide[17 18] and may require greater emotional support and supervision to navigate these challenges. This suggests that there are multiple domains in the clinical LE that warrant closer examination in order to better support the well-being of residents as negative perceptions of the LE may in turn exacerbate burn-out in a vicious cycle. This issue is of particular concern in the field of psychiatry where doctor–patient relationships are a driving force of therapeutic change, and burn-out could reduce residents' ability to empathise and connect with patients.

METHODS
Context
The National Psychiatry Residency Programme in Singapore comprises 5 years of training following initial, generic postgraduate training (postgraduate year 1) after medical school. This programme has been accredited with the Accreditation Council for Graduate Medical Education-International since 2010. It includes various clinical postings across training sites, regular clinical supervision, and a centrally coordinated schedule of formal teaching. All residents in the programme receive didactics together weekly regardless of their clinical posting sites. The

surveys at each time point were administered during such didactic sessions. Attrition in this study can largely be attributed to residents graduating from the programme, taking a leave of absence from residency due to maternity leave, as well as being unable to participate due to busy clinical work. During the period of this study, there were 104 psychiatry residents in the Programme.

Data collection
Data collection tools
The Oldenburg Burnout Inventory (OLBI)[19] was used to assess burn-out levels in residents. The scale consists of 16 items on a 4-point Likert scale, with higher scores indicating higher levels of burn-out. There are two main subscales, namely Exhaustion and Disengagement. Exhaustion is defined as a consequence of intensive physical, affective, and cognitive stress as a result of work. Disengagement is defined as an emotional distancing from patients and colleagues at work. Residents with Exhaustion scores of ≥2.25 and Disengagement scores of >2.1 met the criteria for burn-out.[20] The Cronbach's alpha for our sample at baseline was 0.877 for this measure.

The Postgraduate Hospital Education Environment Measure (PHEEM)[21] was used to assess resident perception of the LE. The scale consists of 40 items with three subscales, namely Perceptions of RA (14 items, maximum score of 56), Perceptions of Teaching (15 items, maximum score of 60), and Perceptions of SS (11 items, maximum score of 44). The sum of these three subscale scores provides an overall rating of LE ranging from 0 to 160. Higher scores indicate a more favourable perception of the LE. The PHEEM has been used in many studies conducted in residency training sites worldwide and is a reliable and valid instrument.[5 22] The Cronbach's alpha for our sample at baseline was 0.816 for RA, 0.908 for Teaching, 0.781 for SS and 0.938 for total PHEEM.

Data collection process
Invitations to take part in the study were sent to all Psychiatry residents between January 2016 and December 2017 by the Chief Resident, and a reminder was sent at each time point. Potential participants were informed that participation was voluntary and would have no impact on their residency evaluations. The questionnaire was administered by paper and pencil, distributed and collected by research staff who were not involved in the residency programme throughout the study. We aimed to collect data over six time points at approximately 4 monthly intervals (ie, over a 2-year period).

Data management
Each respondent was assigned a unique identification number (UIN) at the first time point of data collection. The data linkage file (UIN and identifiable details) was accessed only by research staff. No-one involved in the Residency Programme had access to the linkage file or the raw data.

Analysis

We conducted all analyses using SPSS V.23 (IBM) and R V.3.5.2 (2018). We employed linear mixed modelling in R to examine changes in PHEEM scores over time, while taking into account residents' burn-out status.[23 24] The estimates were chosen to optimise the full maximum likelihood criterion in order to enable comparison of models.[23] The Satterthwaite approximations in the 'lmerTest' statistical package[24] were used to compute the significance of the model parameters. Missing data were taken to be missing completely at random (MCAR). When maximum likelihood is used, it has been found that omission of missing data will still provide unbiased estimates under the assumption that data were MCAR.[23]

First, we ran an unconditional means model to assess the amount of outcome variation that exists at both the within-subject and between-subject level. This identified sufficient variation at each level to warrant the addition of predictors to attempt to explain this variation[25] so we ran an unconditional growth model to predict PHEEM score changes over time. Within-subject and between-subject differences were accounted for as random effects. We then added our variable of interest, burn-out status, into the model as a predictor of both initial PHEEM scores and change over time. Burn-out status was allowed to vary with time (time×burn-out status) to account for the possibility that residents' burn-out status could change over the course of residency. These same steps were applied for predicting total PHEEM scores as well as the three subdomains (RA, SS and Teaching). We looked at all three goodness-of-fit statistics (deviance, Akaike information criterion (AIC), Bayesian information criterion (BIC)) in order to evaluate if each model tested offered a better fit than the previous one.

Patient and public involvement

No patients involved.

RESULTS

Overall, 93 out of 104 residents (response rate 89.4%) took part in the study with 54 (58.0%) males and 39 (42.0%) females. The average age of participants at baseline was 29.5 years. The rate of burn-out at baseline was 55.4%. There were 35 (37.6%) residents in year 1, 17 (18.3%) in year 2, 18 (19.4%) in year 3, 12 (12.9%) in year 4 and 11 (11.8%) in year 5 at baseline. The PHEEM scores (overall and subdomain) over time are provided in table 1.

Linear mixed models for PHEEM total and subdomains

Unconditional means model (no predictors)

We first tested an unconditional means model which describes the within-person and between-person variances in PHEEM total scores in the absence of any predictors. Data from 92 residents were used in all models involving PHEEM total and subdomain scores in RA, and 93 residents for SS and Teaching. Based on the between-person and within-person variances, we calculated the intraclass correlation coefficient which indicated that 46.5% of the variance in PHEEM total scores was the result of between-person differences. For the unconditional means model, we found that 54.4%, 42.1%, 37.9% of the variances in PHEEM RA, SS and Teaching scores, respectively, were the result of between-person differences.

Unconditional growth model (predictor:time)

Next, we fitted an unconditional growth model which introduces the predictor of time into the model in order to explore changes in PHEEM total scores over time. Based on the results, we were able to conclude that the average change trajectory for PHEEM scores had an intercept of 114.3 and a slope of +1.86, which differ significantly from zero (p<0.001 and p<0.01, respectively). The three goodness-of-fit indices (deviance, AIC, BIC) indicated that the addition of time as a predictor resulted in a better fitting model as compared with the unconditional means model. This suggests that time contributed significantly to the prediction of PHEEM total scores. Additionally, 21.4% of the within-person variation in PHEEM total scores was systematically associated with the predictor, time (see table 2).

For PHEEM RA, SS and Teaching scores, the addition of time as a predictor resulted in a better fitting model as compared with the unconditional means model (see tables 3–5).

Table 1 PHEEM scores for each time point

Time point	N	PHEEM total scores (mean (SD))	PHEEM role autonomy scores (mean (SD))	PHEEM social support scores (mean (SD))	PHEEM teaching scores (mean (SD))
Baseline	93	112.3 (16.2)	39.2 (5.81)	29.6 (5.17)	43.3 (6.46)
Follow-up 1	78	118.9 (14.1)	41.4 (5.23)	31.3 (4.82)	46.0 (5.26)
Follow-up 2	64	120.4 (14.5)	41.7 (5.42)	32.0 (4.81)	46.3 (4.99)
Follow-up 3	57	120.7 (14.4)	41.7 (5.58)	31.9 (4.63)	46.9 (5.38)
Follow-up 4	37	117.6 (15.6)	41.3 (5.16)	30.3 (5.25)	45.9 (6.07)
Follow-up 5	25	120.3 (14.0)	42.0 (5.41)	31.4 (4.65)	47.0 (4.80)

PHEEM, Postgraduate Hospital Education Environment Measure.

Table 2 Results of fitting a taxonomy of multilevel models for change in postgraduate education environment measure total scores

	Parameter	Unconditional means model	Unconditional growth model	Final model
Fixed effects				
	Intercept	117.006*** (1.266)	114.3369*** (1.4091)	120.5226*** (1.6658)
	Time		1.8565** (0.5414)	0.9481 (0.6675)
	Burn-out status			−10.8808*** (1.9965)
	Time×burnout status			1.3935 (0.8510)
Variance components				
	Within-person	121.8 (11.04)	95.752 (9.785)	95.395 (9.767)
	In initial status	105.8 (10.29)	116.429 (10.790)	77.646 (8.812)
	In rate of change		8.748 (2.958)	4.425 (2.103)
	Covariance		−0.27	−0.05
No of observations		339	339	337
Goodness-of-fit				
	Deviance	2714.8	2693.6	2641.6
	AIC	2720.8	2705.6	2657.6
	BIC	2732.3	2728.6	2688.2

Note: Full maximum likelihood estimation. Values in parentheses indicate SE or SD.
*p<0.05, **p<0.01, ***p<0.001.
AIC, Akaike information criterion; BIC, Bayesian information criterion.

Final model (predictors: time, burn-out status, time×burn-out status)

We then ran models with the addition of our predictors of interest (burn-out status, time and its interaction term). This allowed us to explore: (1) differences in PHEEM scores between residents with and without burn-out at baseline and (2) differences in rate of change between the burn-out and no-burn-out groups.

The estimated initial PHEEM total score for the average resident without burn-out was 120.5 at intercept

Table 3 Results of fitting a taxonomy of multilevel models for change in postgraduate education environment measure role autonomy scores

	Parameter	Unconditional means model	Unconditional growth model	Final model
Fixed effects				
	Intercept	40.7801*** (0.4805)	39.8598*** (0.5155)	41.9069*** (0.5985)
	Time		0.6257*** (0.1675)	0.3723 (0.2167)
	Burn-out status			−3.6496*** (0.6852)
	Time×burn-out status			0.4295 (0.2812)
Variance components				
	Within-person	13.85 (3.722)	11.5230 (3.3945)	11.1533 (3.3397)
	In initial status	16.55 (4.068)	16.7195 (4.0889)	12.4290 (3.5255)
	In rate of change		0.6159 (0.7848)	0.3357 (0.5794)
	Covariance		−0.12	0.03
No of observations		348	348	346
Goodness-of-fit				
	Deviance	2051.1	2029.6	1981.5
	AIC	2057.1	2041.6	1997.5
	BIC	2068.7	2064.7	2028.3

Note: Full maximum likelihood estimation. Values in parentheses indicate SE or SD.
*p<0.05, **p<0.01, ***p<0.001.
AIC, Akaike information criterion; BIC, Bayesian information criterion.

Table 4 Results of fitting a taxonomy of multilevel models for change in postgraduate education environment measure social support scores

	Parameter	Unconditional means model	Unconditional growth model	Final model
Fixed effects				
	Intercept	30.805*** (0.407)	30.1704*** (0.4716)	32.3774*** (0.5575)
	Time		0.4583* (0.1927)	0.1678 (0.2340)
	Burn-out status			−3.8734*** (0.6790)
	Time×burn-out status			0.4576 (0.2919)
Variance components				
	Within-person	14.48 (3.806)	11.200 (3.347)	11.035 (3.3219)
	In initial status	10.54 (3.246)	13.011 (3.607)	8.232 (2.8692)
	In rate of change		1.245 (1.116)	0.698 (0.8355)
	Covariance		−0.36	−0.22
No of observations		344	344	342
Goodness-of-fit				
	Deviance	2010.6	1993.0	1939.2
	AIC	2016.6	2005.0	1955.2
	BIC	2028.1	2028.1	1985.9

Note: Full maximum likelihood estimation. Values in parentheses indicate SE or SD.
*p<0.05, **p<0.01, ***p<0.001.
AIC, Akaike information criterion; BIC, Bayesian information criterion.

(p<0.001). The average difference between initial PHEEM total scores for residents with and without burn-out was significant (−10.9, p<0.001). In other words, residents with burn-out reported a lower score. However, PHEEM total scores did not change significantly over time for all residents (0.948, ns), and this rate of change did not differ significantly between residents with or without burn-out (1.39, ns). Hence, burn-out status is a significant

Table 5 Results of fitting a taxonomy of multilevel models for change in postgraduate education environment measure teaching scores

	Parameter	Unconditional means model	Unconditional growth model	Final model
Fixed effects				
	Intercept	45.3493*** (0.4504)	44.1757*** (0.5268)	45.9035*** (0.6655)
	Time		0.7968*** (0.2102)	0.5677* (0.2682)
	Burn-out status			−3.0257*** (0.8162)
	Time×burn-out status			0.3348 (0.3463)
Variance components				
	Within-person	20.15 (4.489)	16.294 (4.037)	16.833 (4.1028)
	In initial status	12.31 (3.508)	14.846 (3.853)	11.108 (3.3329)
	In rate of change		1.276 (1.129)	0.696 (0.8343)
	Covariance		−0.39	−0.26
No of observations		351	351	349
Goodness-of-fit				
	Deviance	2155.4	2134.9	2105.4
	AIC	2161.4	2146.9	2121.4
	BIC	2173.0	2170.1	2152.3

Note: Full maximum likelihood estimation. Values in parentheses indicate SE or SD.
*p<0.05, **p<0.01, ***p<0.001.
AIC, Akaike information criterion; BIC, Bayesian information criterion.
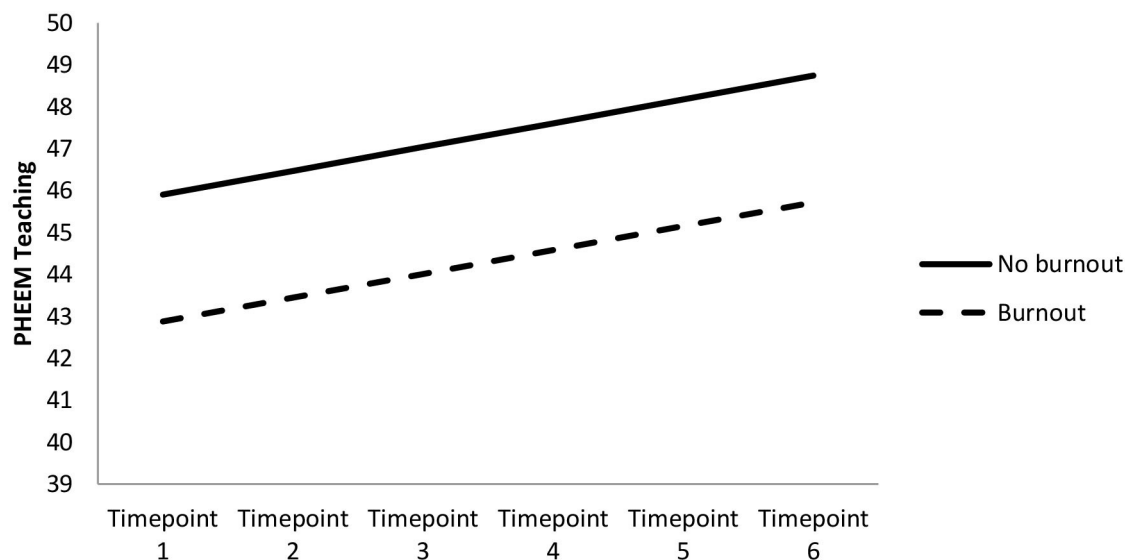
Change in PHEEM Teaching Scores

Figure 1 Final model for postgraduate hospital education environment measure (PHEEM) teaching scores over six time points (January 2016 to December 2019) for residents from the National Psychiatry Residency Programme.

predictor of PHEEM total scores at baseline but not the magnitude or rate of PHEEM score change over time (see table 2).

For PHEEM RA and SS, burn-out status is a significant predictor of PHEEM RA and SS scores at baseline but not its magnitude or rate of change over time (see tables 3 and 4).

The estimated initial PHEEM Teaching score for the average resident without burn-out was 45.9 at intercept (p<0.001). The average difference between PHEEM Teaching scores at baseline for residents with or without burn-out was significant, and residents suffering from burn-out reported a lower score (−3.03, p<0.001). In contrast to the other PHEEM domains, we also found that PHEEM Teaching scores for all residents showed a significant and positive change over time (0.568, p<0.05) (refer figure 1). Nonetheless, the estimated difference in rate of change of PHEEM Teaching scores for residents with or without burn-out did not reach significance (0.335, ns) (see table 5).

DISCUSSION

There were two main findings. First, burn-out status was a significant predictor of overall and all subdomain scores of PHEEM at baseline. Specifically, presence of burn-out was associated with poorer perception of the overall LE and in all three PHEEM subdomains of Perceptions of RA, Teaching and SS. Second, the Teaching subdomain scores of the PHEEM (but not RA or SS) showed a significant increase over time for all residents regardless of burn-out status, indicating a more favourable perception of teaching over time for the whole cohort.

That burn-out was a significant predictor of lower LE scores resonates with findings from cross-sectional

studies using various rating tools including the PHEEM.[6 9 10 26 27] Although direct comparisons between studies can be limited by varying definitions and tools used to assess burn-out, the rate of burn-out among residents at baseline in our study (55.4%) was consistent with other studies which ranged from 19.6%[6] to 67.0%.[26] That the findings of our study align with those of previous studies of residents from other countries, including North America (US),[9] South America (Buenos Aires),[6] Europe (Belgium and Greece),[10 27] and Australia[26] suggests that, despite differences in setting and specialties, the inverse relationship between burn-out and perception of the LE is consistent.

Interestingly, other tools used to evaluate LE appear to evaluate domains similar to the PHEEM. For example, the Dutch Residency Educational Climate Test used by van Vandeloo et al[10] examined learner's RA in the item of 'work that was adapted to residents' competence', teaching in the item of 'coaching and assessment' and 'formal education', and SS in the item of 'teamwork' and 'resident peer collaboration'. In short, although the tools are different, the underlying constructs measured seem similar. Most studies used the Maslach Burnout Inventory and its subscales to measure burn-out among residents.[6 9 10 26] We used the OLBI as it measures specifically two relevant dimensions of burn-out (energy/exhaustion and engagement/disengagement),[19] has been widely used internationally[28] and has been previously adopted in local studies.[29]

That only the PHEEM Teaching subdomain score increased over time could be accounted for by the fact that it is arguably a more tangible and visible aspect of the LE than perceived RA or SS subdomains. Having 'protected educational time' and 'access to educational

programmes' as evaluated by PHEEM teaching are more tangible and objective aspects of the LE as compared with having 'the appropriate level of responsibility' (as evaluated by RA) or having 'good collaboration with other doctors in my grade' (as evaluated by SS). Previous cross-sectional studies have also reported a robust relationship between positive perception of academic teaching or support and less burn-out in residents in training.[26 27 30] Support in the form of provision of academic resources is one way that allows residents to feel valued by the organisation.[30] Tailored supervision may also cater better to the unique learning needs of each resident,[26] reducing academic stress and in turn, the risk of burn-out and better perception of the LE. Conversely, early identification of those at risk of burn-out could also be aided by the periodic evaluation of PHEEM teaching scores within the residents.

Of note, our scores for total PHEEM, RA and Teaching were higher than those of previous cross-sectional studies which also employed the PHEEM as a measure of LE among residents.[6 27] This may be due to differences in culture and the nature of the healthcare system in countries where the studies were conducted (Argentina and Greece vs Singapore), as well as differing expectations of the residents. For example, learners in Asian cultures tended to be more tolerant of the educational system and deferential towards the teachers and support community around them,[31] hence rating higher on these items related to LE.

Implications for practice

Based on the findings in this study, we suggest several interventions relevant to psychiatry and other residency programmes.

First, the finding of improvement of perception of Teaching subdomain in LE over time indicates the importance of further strengthening teaching during residency. Teaching should seek to build on residents' progress over time in the areas of competency, autonomy and relatedness.[32] This will involve continual engagement of residents by faculty members in order to build a sense of belonging (relatedness), equipping them with skills and knowledge over time through teaching sessions (competency) and giving residents the opportunity to mentor others or offer input into the curriculum (autonomy).[3] Some aspects of belongingness include the gradual integration of junior residents into their professional communities of practice,[33] and ensuring fair representation and treatment such as across gender and race.[34]

Second, concomitantly, there is a need to further empower residents in terms of greater RA and SS.[3 32] Apart from faculty support, peer support from other residents is likely to be crucial in ensuring that learning is enhanced through the transition from legitimate peripheral participation to full participation.[33] A previous study has found that the relationship between role stress and burn-out is stronger when job autonomy is lower.[35] In addition, the relationship between role stress and turnover intention is

also stronger when SS is lower.[35] This suggests that both RA and SS are potential targets for intervention due to their mediating effects on other related factors.[35]

Third, the association of burn-out with overall lower PHEEM scores highlights the need to address burn-out through individual and organisational measures. Given that one of the preceding factors of burn-out is a lack of balance between job demands and one's resources,[36] putting structures in place which enable regular review of actual and perceived job demands may allow faculty to identify and address issues early. Other measures include an emphasis on self-care skills training which can incorporate psychotherapy skills,[37] effective communication between faculty and residents,[36] frequent review of processes and openness to feedback,[38] as well as timely addressing of concerns.

Strengths and limitations

The strength of this study was its longitudinal data collection, adding insight into how burn-out and perceptions of the LE change over time. Psychiatry is a specialty with high burn-out rates[1 12] yet this study is one of the first to look at the associations between the burn-out and the LE in psychiatry residents. Although burn-out can affect perceptions of the LE and its trajectory over time, it is also possible that LE may itself predispose residents to burn-out, or be protective against burn-out. For example, a recent study observed that the phenomenon of emotional contagion was present among healthcare professionals.[39] However, compared with nurses, doctors absorbed both joy and anger only from their colleagues, with leaders and patients playing a comparatively small role in influencing their levels of positive and negative emotions.[39] Both joy and anger absorbed from colleagues were significant predictors of feelings of exhaustion and cynicism (facets of burn-out) among doctors.[39] This demonstrates the bidirectional relationship that could exist between LE and burn-out, such as in the area of SS from peers. In addition, we did not employ mixed methods in our study design which limits our ability to draw firm conclusions about the directionality of this relationship. Future studies may seek to use qualitative methods in addition to quantitative ones to further elucidate the relationship among these variables.

The attrition rate in our study is notable as well. Reasons for this include residents graduating from the programme, taking a leave of absence from residency due to maternity leave, as well as those who could not participate due to busy clinical work. We recognise that there are also residents who were unable to complete the programme and had to drop out of residency. This could have given rise to survivorship bias and results reported may not be fully representative of the experiences of all residents initially admitted into the programme. Nonetheless, with regard to residents who remained in the programme, participation rates for the first few time points of our study were better compared with other studies with fewer follow-up sessions.[40] Second, no sample

size calculation was required as the study was a survey of the whole cohort of psychiatry residents in Singapore over the short study period. Although the number of participants was limited by the size of the programme, the use of linear mixed models allowed us to maximise the appropriate data included for the analyses. Third, focusing on one programme facilitated follow-up but limits the generalisability of our findings to other residency programmes and contexts. However, given that majority of the related studies are conducted in the West,[12] this study provides insight into how the relationship between burn-out and LE holds even across different cultural contexts. Fourth, the observed rates of burn-out can differ depending on the instrument used as well as threshold criteria chosen.[12 41] Mixed methods (qualitative and quantitative) should be considered in other studies which can also help in characterising the extent and type of distress residents face.

Future studies may seek to replicate our longitudinal findings with larger cohorts of residents, particularly in understudied specialties and countries. Other outcomes associated with the LE could be further studied, including further career sub-specialisation after residency training, given that experiences of teaching and learning influence decision making in medical careers.[42]

Conclusion

In conclusion, we found that perceptions of LE among psychiatry residents at baseline are associated with burn-out status. We suggest that further studies are needed to identify, implement and evaluate personal, programme and systems-level interventions to address burn-out and improve perceptions of the LE, to enhance learning of our learners in training.

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