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# Residency schedule, burnout and patient care among first-year residents

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## ABSTRACT

**Background** The 2011 US Accreditation Council for Graduate Medical Education (ACGME) mandates reaffirm the need to design residency schedules to augment patient safety and minimise resident fatigue.

**Objectives** To evaluate which elements of the residency schedule were associated with resident burnout and fatigue and whether resident burnout and fatigue were associated with lower perceived quality of patient care.

**Methods** A cross-sectional survey of first-year medicine residents at three hospitals in May–June 2011 assessed residency schedule characteristics, including hours worked, adherence to 2003 work-hour regulations, burnout and fatigue, trainee-reported quality of care and medical errors.

**Results** Response rate was 55/76 (72%). Forty-two of the 55 respondents (76%) met criteria for burnout and 28/55 (51%) for fatigue. After adjustment for age, gender and residency programme, an overnight call was associated with higher burnout and fatigue scores. Adherence to the 80 h working week, number of days off and leaving on time were not associated with burnout or fatigue. Residents with high burnout scores were more likely to report making errors due to excessive workload and fewer reported that the quality of care provided was satisfactory.

**Conclusions** Burnout and fatigue were prevalent among residents in this study and associated with undesirable personal and perceived patient-care outcomes. Being on a rotation with at least 24 h of overnight call was associated with higher burnout and fatigue scores, but adherence to the 2003 ACGME work-hour requirements, including the 80 h working week, leaving on time at the end of shifts and number of days off in the previous month, was not. Residency schedule redesign should include efforts to reduce characteristics that are associated with burnout and fatigue.

## INTRODUCTION

On 1 July 2011, graduate medical education in the USA changed dramatically with initiation of new Accreditation Council for Graduate Medical Education (ACGME) common programme requirements limiting continuous duty hours for first-year residents to 16 and requiring continuous supervision.<sup>1</sup> Similar reductions in work hours have been mandated in Europe.<sup>2</sup> Compliance with these new regulations forced residency programmes to make fundamental changes in scheduling, coverage and supervision (table 1).<sup>1–3</sup> Concerns about the effect of these changes on resident education, quality of

life and the quality of patient care have been raised and have been part of the impetus behind the Next Accreditation System, which focuses on assessment of competencies.<sup>4–6</sup> Pilot studies of the new schedules and a recent national survey of residents have not shown consistent improvement in patient outcomes. Instead, they suggest a trend towards lower reported education quality, more burnout and fatigue and lower quality of life.<sup>7–10</sup> Thus, uncertainty remains about the optimal residency schedule to improve patient safety and minimise resident fatigue.<sup>11</sup>

Burnout and fatigue are highly prevalent among medical residents, especially during the intern year.<sup>12–13</sup> Burnout, defined as emotional exhaustion and a reduced sense of personal accomplishment associated with prolonged occupational stress, is characterised by poor quality of life and has been associated with adverse patient-care outcomes, including self-reported medical errors and poor perceived quality of care.<sup>14–15</sup> A number of personal characteristics are associated with burnout, including age, gender, specialty and personality type, as well as financial factors such as debt.<sup>12–16</sup> Several studies after the 2003 ACGME duty-hour limits showed modest decreases in burnout, but evidence linking burnout to work hours has been mixed.<sup>13–17–20</sup>

As improving patient safety is a central motivation for work-hour reform, it is critical to understand the association between residency scheduling, burnout and patient outcomes. We explored the relationship among aspects of residency scheduling and adherence to ACGME work-hour restrictions and resident burnout, fatigue and self-reported quality of patient care in internal medicine residents before implementation of the 2011 ACGME work-hour reforms. We hypothesised that (1) scheduling factors and non-adherence to pre-2011 ACGME guidelines would be associated with resident burnout and fatigue and that (2) higher levels of burnout and fatigue would be associated with lower reported quality of life and perceived quality of patient care.

## METHODS

### Study design

We performed a cross-sectional survey of first-year internal medicine residents at three residency programmes in Baltimore. Participants completed a one-time online questionnaire in May–June 2011. An online format was chosen to maximise distribution, avoid disruption of the working day for residents and minimise interviewer effects.

**Table 1** Comparison of ACGME resident duty hours standards for PGY-1 residents, 2003 and 2011<sup>1</sup>

	2003 Standards	2011 Standards
Supervision	Appropriate supervision of residents in patient-care activities	PGY1 residents should be supervised either directly or indirectly with direct supervision immediately available
Hours per week	80, averaged over 4 weeks	80, averaged over 4 weeks
Days off	One in 7 days, averaged over 4 weeks	One day every week, averaged over 4 weeks
Maximum duty period	24 h plus 6 h to transfer care	16 h

## Subjects

We studied first-year internal medicine residents at a large academic medical centre (programme 1), a smaller affiliated academic medical centre (programme 2) and a community hospital (programme 3).

## Approval and consent

Written informed consent was obtained from all subjects. Study approval was granted by the Johns Hopkins University School of Medicine Institutional Review Board.

## Questionnaire

The questionnaire (see online supplementary file) consisted of 22 questions, some of which included subitems. Resident schedule was assessed using questions about hours worked in the previous week, current rotation and adherence to specific ACGME work-hour guidelines, such as number of days off and leaving within 30 h on a post-call day. Overnight call was defined as working a 24 h shift or longer a minimum of every 4 days during the rotation. Residents on a 'night float' system, in which a pool of residents are assigned to night-time duties for a period of time and do not perform daytime work, were not categorised as taking overnight call. Adherence to ACGME guidelines was a

composite variable defined as leaving within 30 h of arrival 100% of the time during the last rotation that included overnight call, working  $\leq 80$  h in the previous week and having at least 4 days off in the previous month.

Burnout was measured using a six-item, previously derived version of the Maslach Burnout Inventory (score range 6–30).<sup>21–22</sup> Fatigue was measured using the Epworth Sleepiness Scale (score range 0–24).<sup>23</sup> Additional outcomes included (1) resident-reported medical errors, using items derived from a previously published questionnaire; (2) handover safety, using an item derived from a previous study of safety of resident handovers; (3) safety attitudes, measured using items from the Safety Attitudes Questionnaire teamwork, safety and collaboration domains and (4) ACGME core competencies, measured by perceived competence in practice-based learning, interpersonal and communication skills and systems-based practice.<sup>24–27</sup> We also assessed resident-reported quality of personal life and work life, quality of education received and quality of patient care provided using newly developed items which were pilot tested with a group of second-year residents.

## Analysis

Respondent characteristics were grouped by residency programme and analysed using  $\chi^2$  tests. Bivariate and multivariable linear regression models were used to determine whether demographic, hospital and scheduling factors were associated with burnout and fatigue. Kendall's tau b was used to test the association between burnout and fatigue and reported quality of life and patient care. Residents were divided into tertiles of burnout and fatigue scores to create comparably sized ordinal groups for tau b analyses and asymptotic SEs were used to calculate significance levels.<sup>28</sup> All analyses were performed using STATA 11IC (College Station, Texas, USA).

## RESULTS

All 76 first-year medicine residents in the three programmes were eligible to participate, of whom 55 completed the questionnaire (response rate of 72%). Twenty-six of the 55 respondents were female (47%) and mean age was 29 years (table 2).

**Table 2** Respondent characteristics by residency programme

Characteristics	Total N (%/SD)	Programme 1 N (%/SD)	Programme 2 N (%/SD)	Programme 3 N (%/SD)
Total	55	29 (53)	15 (27)	11 (20)
Sex, female	26 (47)	11 (38)	8 (53)	7 (64)
Age (years), mean	29 (3)	29 (3)	30 (3)	27 (2)
On overnight ( $\geq 24$ h) call rotation**	34 (62)	26 (90)	5 (33)	3 (27)
Hours worked in past week				
$\leq 80$	47 (85)	22 (76)	14 (93)	11 (100)
$> 80$	8 (15)	7 (24)	1 (7)	0
Days off $< 4$ in past month	9 (16)	6 (21)	2 (13)	1 (9)
Leave on time 100%†	16 (36)	12 (41)	4 (27)	–
Adherence to pre-2011 ACGME rules*†	13 (30)	10 (34)	3 (20)	–
Burnout (Maslach 13–17)	20 (36)	12 (41)	4 (27)	4 (36)
High burnout (Maslach $> 17$ )*	22 (40)	16 (55)	5 (33)	1 (9)
Fatigue (Epworth 10–15)	17 (31)	9 (31)	6 (40)	2 (18)
High fatigue (Epworth $> 15$ )	11 (20)	9 (31)	2 (13)	0

\*p value of  $\chi^2$  test  $< 0.05$  comparing the three programmes; \*\*p value  $< 0.001$ .

†Residents in programmes 1 and 2 only were asked this question.  
ACGME, Accreditation Council for Graduate Medical Education.

Thirty-four of the 55 residents were on an overnight call rotation at the time of questionnaire completion (62%). A total of 13/44 (30%) reported adherence to all ACGME requirements. Forty-two of the 55 respondents (76%) met criteria for burnout and 28/55 (51%) met criteria for fatigue. Overnight call rotation, adherence to ACGME requirements and high burnout varied significantly among residency programmes.

Overnight call rotation means on a rotation with 24 h of in-hospital work at least every fourth night. Hours worked in past week refers to total number of hours reported during the most recent week of inpatient work. Days off refers to number of 24 h periods free from work during the previous 4 weeks. Leaving on time signifies reporting leaving within 30 h of arrival for the most recent rotation with overnight call. Adherence to pre-2011 ACGME rules is a composite measure which includes working  $\leq 80$  hours, having at least 4 days off and leaving on time 100% of the time. Burnout was measured using a modified Maslach scale.<sup>21 22</sup>

### Association between scheduling factors, burnout and fatigue

In bivariate analysis of individual scheduling factors, being on an overnight call rotation, total number of hours worked in the previous week, residency programme and fatigue score were each associated with higher burnout score (table 3). Leaving on time, working  $>80$  h a week, days off and adherence to ACGME guidelines were not associated with burnout. In a multivariable linear regression adjusted for age, sex and residency programme, only overnight call was associated with higher burnout score.

In bivariate analysis, overnight call ( $\beta=5.3$  (SE 1.4)) and programme 1 vs. programme 3 ( $\beta=4.8$  (SE 1.9)) were significantly associated with higher fatigue score. In multivariable analysis adjusted for age, sex and residency programme, only overnight call rotation remained significantly associated with higher fatigue score ( $\beta=5.5$  (SE=1.7)).

### Association between burnout, fatigue and patient outcomes

Higher burnout scores were associated with lower resident-reported quality of life and education (figure 1). Those with high burnout were significantly less likely to report at least 'good' quality of education, quality of patient care provided and quality of work and personal life. Furthermore, those with higher burnout scores were less likely to report forming positive patient–doctor relationships and engagement with other

healthcare professionals to improve quality of care. Conversely, residents with lower burnout were more likely to report feeling prepared to be a PGY2 resident.

Higher burnout scores also tended to be associated with self-reported errors and poorer reported safety (figure 1). Residents with higher burnout scores were more likely to report at least 'sometimes' forgetting to convey important information during rounds and making errors owing to excessive workload. Residents with high burnout were less likely to report agreement at least 'mostly' with safety questions about patient care and teamwork than residents with low burnout scores.

Fatigue level was significantly associated with perceived hand-over safety. Residents in the highest tertile of fatigue scores were less likely to report spending above the median time preparing for handovers (5/17 (29%) vs 18/22 (82%),  $p<0.001$ ) than residents with low fatigue scores and were less likely to report that the quality of handovers received was 'good' or better (11/17 (65%) vs 21/22 (95%),  $p<0.01$ ). Residents with high fatigue scores were less likely to report being prepared to be a resident and less likely to report good quality of personal life. Residents with fewer days off were less likely to report at least 'good' quality of patient care. Residents who left on time were not more likely to report any better outcomes in safety, relationships or care quality.

## DISCUSSION

This cross-sectional survey evaluated work schedule, burnout, fatigue, quality of life and reported patient-care outcomes among residents from three internal medicine residency programmes at the end of their intern year. Burnout and fatigue were highly prevalent in this sample, occurring in over half of responding residents. Those who worked more in the past week, who were on an overnight call rotation and who were sleepier were more likely to report burnout. After controlling for multiple factors including residency programme, being on an overnight call rotation was the only predictor of both burnout and fatigue.

This study focused on exposures and outcomes associated with burnout and fatigue. As expected, being on a rotation involving 24–30 h of overnight call, as opposed to rotations with shorter shift lengths, was predictive of both burnout and fatigue. Adherence to other ACGME requirements, including the 80 h working week, leaving on time at the end of shifts, number of days off in the previous month and adherence to all of these requirements was not associated with burnout or fatigue. Burnout, rather than fatigue, leaving on time, or number of days off, was associated with resident quality of life, patient–doctor relationships, perceived quality of patient care and self-reported measures of patient safety.

These results are consistent with previous findings that burnout is prevalent among residents in the USA and in other countries and associated with perceived medical errors and lower quality of patient care.<sup>29–31</sup> Previous studies have found that demographic and personal factors help explain why certain residents suffer burnout and others do not.<sup>16</sup> Some previous studies have shown an association between working more hours a week and being burned out, and burnout rates after the 2003 work-hour reforms are somewhat reduced.<sup>32 33</sup>

In addition to programme schedules and personalities, residency programme 'culture' and other hospital-specific factors may contribute to burnout. Resilience to burnout, on the other hand, may be partly innate or may be the result of certain contextual and environmental factors.<sup>34</sup> Within residency programmes, differing levels of patient-care responsibilities, patient

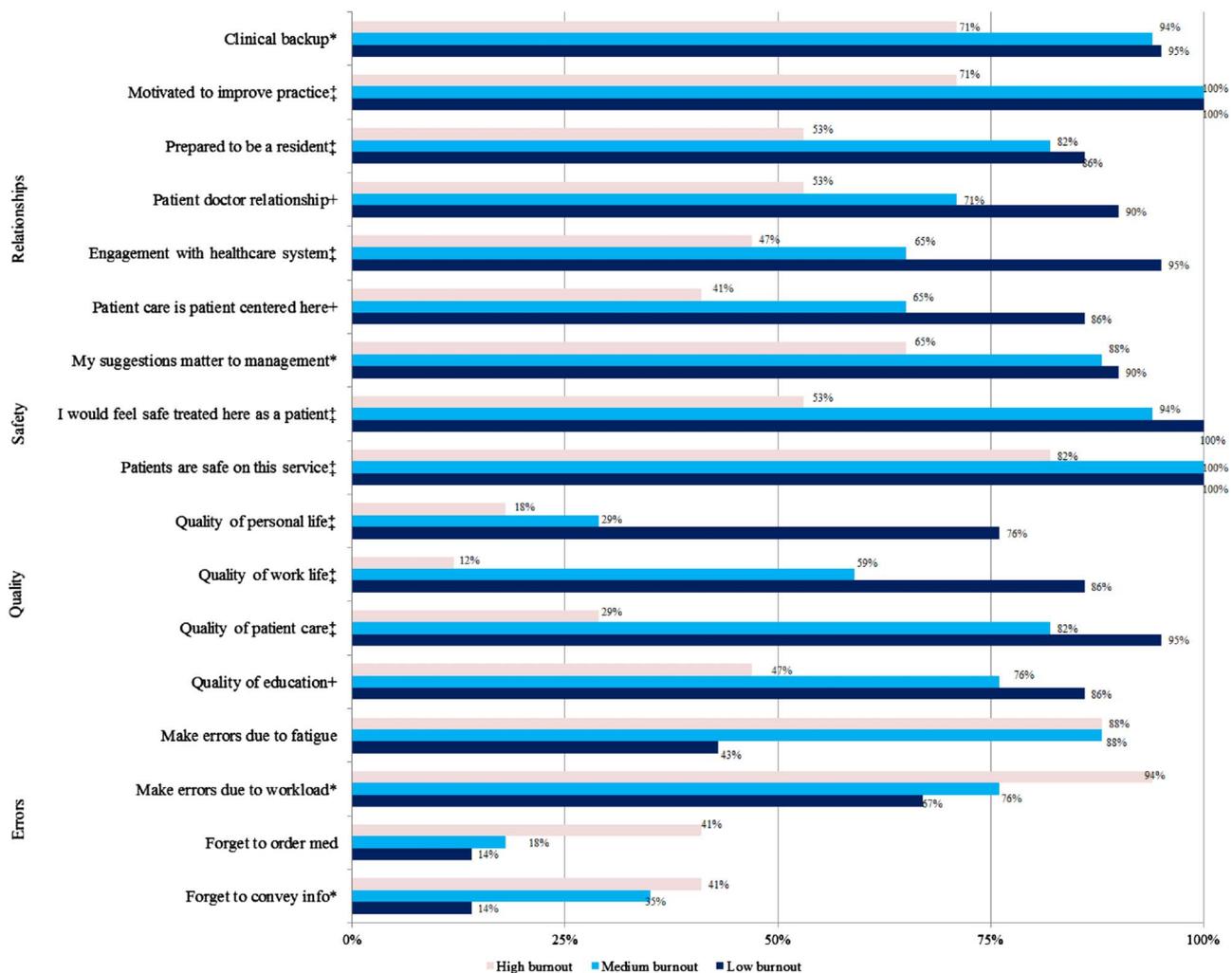
**Table 3** Factors associated with burnout score

Factors	Unadjusted model $\beta$ coefficient (SE)	Adjusted model† $\beta$ coefficient (SE)
Overnight rotation	6.6*** (1.5)	3.4* (1.7)
Hours worked	0.2** (0.1)	0.03 (0.1)
Fatigue score	0.5** (0.1)	0.3 (0.1)
Working over 80 h	3.3 (2.3)	0.02 (2.1)
Days off	1.4 (1.0)	1.7 (0.9)
Leaving on time	0.5 (1.8)	−0.01 (1.6)
Adherence to ACGME guidelines	−0.9 (1.7)	1.9 (1.7)
Programme 2 vs programme 1	−5.9** (1.6)	
Programme 3 vs programme 1	−7.7*** (1.8)	

\* $p<0.05$ ; \*\* $p<0.01$ ; \*\*\* $p<0.001$ .

†Adjusted for age, sex and residency programme.

ACGME, Accreditation Council for Graduate Medical Education.



**Figure 1** Probability of reporting errors, quality of life, quality of care and safety by burnout level. Respondents were divided by tertile of burnout score. Proportions listed are probabilities of reporting errors at least 'sometimes,' reporting quality of life and relationships as 'good' or better, or reporting at least 'somewhat agree' with questions about safety attitudes. \* $p < 0.05$ ; +  $p < 0.01$ ; ‡  $p < 0.001$  for Kendall's tau b ordinal statistic comparing the three burnout tertiles. Access the article online to view this figure in colour.

volume, patient complexity or rotation-specific circumstances may help to explain why certain residents have more burnout than others.

Previous research has found that residents on overnight call rotations slept less than residents on schedules with shorter periods of continuous work, such as night float schedules.<sup>35</sup> This was supported by our finding that being on an overnight call rotation was associated with resident fatigue. Total hours worked were not associated with fatigue, perhaps because family life and commitments also influence sleep patterns, or because changing schedules and high stress level affect sleep quality irrespective of total hours worked. Not surprisingly, resident fatigue was associated with reports of lower quality handovers. Previous reports suggest that resident handovers are often performed under suboptimal conditions, including being carried out in public places, interrupted frequently and without allowing the recipient to ask questions.<sup>25</sup> Fatigued residents may be more likely to complete handovers under these suboptimal conditions and in a rushed manner.

### Limitations

Our study had several limitations. First, the cross-sectional design limited the ability to infer causal relationships among

variables. For example, though burnout is considered a chronic condition, it may vary based on a resident's current workload and rotation. Fatigue may vary based on position within the call schedule, and reported attitudes to safety or errors may be coloured by a recent experience. However, by examining work schedules, burnout and fatigue and reported patient outcomes, we were able to consider risk factors for, and outcomes associated with, burnout and fatigue. Second, we performed the survey late in the year, when residents had been in their programme for at least 10 months, work habits were solidified and residents were probably at the top of their learning curve. This may not be representative of the intern year or all residents. A follow-up study dealing with the same domains 1 year after implementation of the 2011 ACGME reforms is now being analysed. Third, our sample size was small and all respondents were residents in internal medicine, rather than other specialties, which may limit the generalisability of our findings. However, respondents were drawn from three residency programmes of different types, increasing external validity. Fourth, there may be selection bias in those who chose to complete an online questionnaire, but our response rate was sufficient to attenuate this effect. Fifth, in addition to validated instruments to measure burnout and fatigue, we used newly developed items to evaluate

quality of life and patient care which had not been validated. Finally, we were unable to adjust our model for relevant demographic and personal factors which might affect burnout, such as family support.

### Implications

The 2011 US ACGME 'Common Programme Rule,' which limits to 16 h the length of continuous shifts that first-year residents may work, has been debated by trainees, educators and the public.<sup>4 5</sup> The associations we identified between being on an overnight call rotation and burnout and fatigue, even after adjustment for covariates, suggests that work-hour reform may help in reducing burnout and fatigue among residents. However, as overnight call is still permitted for residents after the PGY1 year, new work-hour regulations may not significantly change burnout and fatigue among these residents. As workload is pushed upwards, it may have deleterious effects. We also found that the total number of hours worked did not affect these outcomes, indicating that other non-regulated variables such as timing of shifts may be as important as continuous duty hours. Further study is needed to determine which variables can mitigate these outcomes in practice and whether first-year residents report less burnout and fatigue under the 2011 ACGME regulations. A follow-up study is planned to answer with this question.

The association between hours worked in the previous week and burnout was attenuated after adjustment for residency programme. As residency-specific factors such as social support at work may affect burnout, interventions to improve the work environment may be needed to help mitigate burnout, particularly for those with high burnout levels.<sup>16 36</sup> Identifying residents at high risk for burnout and fatigue and those relatively 'protected' may be the first step towards intervening to improve quality of life and patient-care practices.

It is important for educators to recognise that burnout and fatigue are common among residents. Programme directors and trainees should be aware that both are associated with undesirable personal and patient-care outcomes. It is clear that interventions to prevent, identify and mitigate burnout are needed. Although stress management programmes have been somewhat effective in reducing burnout, focusing on resident 'wellness' and designing residency schedules to maximise resident control of their work environment may be effective in minimising the onset of burnout.<sup>36 37</sup>

In conclusion, while burnout and fatigue are prevalent among medical residents, risk factors in their development and preventive strategies have been difficult to elucidate. Work-hour reform

### Current research questions

- ▶ How can we identify residents at high risk for burnout so as to intervene earlier?
- ▶ Have the 2011 Accreditation Council for Graduate Medical Education (ACGME) work-hour requirements mitigated resident burnout and fatigue?
- ▶ Will shorter continuous work periods and increased supervision for residents be associated with improved patient safety?

hinges on the hypothesis that shorter continuous work shifts will improve patient safety by reducing resident fatigue and improving supervision. In this study, working an overnight call rotation was more predictive of burnout and fatigue than adherence to the 80 h working week, to continuous duty hour limits, or to the requisite number of days off. As residency schedules continue to be redesigned, focus should be placed on reducing characteristics that are associated with burnout and fatigue.

**Contributors** LB, AWW, LF, SVD were involved in the study concept and design. LB was involved in data acquisition. LB, H-CY, AWW analysed and interpreted the data. LB, LF, AWW, SVD drafted the manuscript. LB, AWW, LF, H-CY, SVD critically revised the manuscript for important intellectual content and approved the final version.

**Competing interests** None.

**Ethics approval** Johns Hopkins University School of Medicine institutional review board.

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**Data sharing statement** All authors had access to the primary data from this study. The corresponding author had access to all unpublished data used in this study and takes primary responsibility for these data.

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### Main messages

- ▶ Working 24 h shifts or longer on an overnight call rotation was associated with burnout and fatigue among first-year medical residents.
- ▶ Adherence to other Accreditation Council for Graduate Medical Education (ACGME) work-hour guidelines, including the 80 h working week, leaving on time and days off, were not associated with burnout or fatigue.
- ▶ Residency schedule redesign should be informed by an understanding of the association between work hours, burnout and patient safety.

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