ACGME Duty Hour Revisions and Self-Reported Intern ICU Sleep Schedules

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Abstract

Background The Accreditation Council for Graduate Medical Education duty hour standards restrict continuous duty for postgraduate year (PGY)–1 residents to 16 hours.

Objective We aimed to assess the relationship between a duty hour–compliant schedule and resident sleep.

Methods To comply with 2011 duty hour limits, Beth Israel Deaconess Medical Center restructured its intensive care unit call model for internal medicine PGY-1 residents from a traditional shift model to an overlapping shorter-duration shift model with preserved educational periods. Before and after schedule changes, we used daily surveys of PGY-1 residents to collect self-reported data on quantity and quality of sleep and quality of education.

Results A total of 1162 surveys were sent to 43 interns before scheduling changes, and 1305 were sent to 41 interns after the changes. Response rate was 31.2% (362 of 1161) before and 22.2% (290 of 1305) after. Before changes, 57.7% (209 of 362) reported receiving 6 hours or more of sleep in a 24-hour period compared to 72.4% (210 of 290) after the changes (adjusted relative risk, 1.33; 95% CI, 1.15–1.53), with an adjusted difference of 0.83 hours of sleep per 24 hours (95% CI, 0.28–1.38). After the intervention, on a 5-point Likert scale, residents reported higher quality of sleep (odds ratio [OR], 1.62; 95% CI, 1.01–2.60) and greater satisfaction with their education (OR, 2.59; 95% CI, 1.40–4.81).

Conclusions Following conversion to a duty hour–compliant model with preserved didactic time, PGY-1 residents reported minor increases in quantity and quality of sleep per 24-hour period, and increased satisfaction with the educational experience.

Editor's Note: The online version of this article includes the survey instrument used in the study.

Introduction

The relationship between sleep and physician performance has been a notable academic literature topic for more than 40 years.[1–3] In recent years, this discussion has focused on the connection between resident duty hours and patient safety.[4,5]

Beginning in 2003, the Accreditation Council for Graduate Medical Education (ACGME) adopted standards across all residencies regarding resident duty hours that limited residents to 30 consecutive hours and 80 weekly hours.[6] In 2011, the ACGME revised its standards to limit postgraduate year (PGY)–1 resident continuous duty to 16 hours.[7–9]

Few studies have described and evaluated scheduling models that comply with the latest ACGME revisions and their effects on resident sleep and education.[10–13] This study aimed to assess self-reported PGY-1 sleep and educational experience during intensive care unit (ICU) rotations before and after scheduling changes in response to the new ACGME duty hour regulations.

Methods

Schedule Changes

Before the ACGME standards change, the internal medicine residency program at Beth Israel Deaconess Medical Center (BIDMC) scheduled critical care rotations with 3 PGY-1 residents on a traditional 28-hour call block schedule (FIGURE). Following regulatory changes that went into effect July 2011, the PGY-1 resident schedule was altered to eliminate shifts longer than 16 hours and use 3 PGY-1 residents rotating between day shifts and an overnight shift. One night per week, the role of the overnight PGY-1 resident was assumed by a senior resident to allow for compliance with weekly duty hour limitations.

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Funding: The authors report no external funding source for this study.

Conflict of Interest: The authors declare they have no competing interests.

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Received July 17, 2013; revisions received December 2, 2013, and January 23, 2014; accepted May 5, 2014.

DOI: http://dx.doi.org/10.4300/JGME-D-13-00263.1

Shifts were structured such that all residents were present for a standard 8 AM ICU educational curriculum.

Survey

We created a survey instrument to assess perceived quantity of sleep and perceived quality of sleep and education (provided as online supplemental material). To promote ease of response, we limited our survey to 5 questions, including ICU location, quantity of sleep during the preceding 24 hours, qualitative assessment of sleep using predefined response categories, and used a 5-point Likert scale regarding satisfaction with education. Question content was developed in conjunction with a focus group of medical educators and resident physicians to ensure accuracy and appropriateness.

Daily surveys were delivered via e-mail to PGY-1 medicine residents on critical care rotations before (February through June 2011) and after (February through June 2012) the July 2011 implementation of the changes in duty hour standards.

This research protocol was certified exempt by the Beth Israel Deaconess Medical Center Committee on Clinical Investigations.

Statistical Analysis

Based on ACGME standards requiring a minimum of 8 hours between shifts, and allowing for an hour of transit and personal care before and after each shift, we chose to use reported receipt of 6 hours or more of sleep in any 24-hour period as our primary outcome measure. Sleep quantity was also evaluated as a continuous variable. Unadjusted comparisons for continuous variables were performed by using Student *t* tests, and for categorical variables by using χ^2 tests. All adjusted models controlled for sex, ICU location, and month of the year. The adjusted relative risk of our primary outcome after the intervention was calculated by using a generalized estimating equation model with a Poisson distribution, log link, and exchangeable working correlation structure to account for within-participant correlated data. We used another generalized estimating equation model with a normal distribution and identity link to compare quantity of sleep as a continuous variable before and after the intervention. Changes in Likert-scale responses related to perceived sufficiency of sleep and quality of education were evaluated by using ordinal logistic regression with a multinomial distribution and a cumulative logit link.

To examine the effect of nonresponse, we performed a sensitivity analysis, in which we assumed a completely null effect (ie, regression coefficient of 0) among the entire pool of missing surveys (ie, no overall difference in sleep before and after the intervention). We assumed a variance around the null estimate similar to that in the observed data but proportional to the sample size of missing surveys. We then calculated a pooled risk ratio for our observed and estimated data by using a fixed-effect meta-analysis.

What was known

Few studies have assessed the effect of the ACGME's 2011 limit of 16 duty hours for first-year residents.

What is new

A study of the 16-hour limit for PGY-1 residents in an intensive care unit setting; outcomes included self-reported sleep, restfulness, and perceived quality of education.

Limitations

Single-specialty, single institution study, low response rate, and potential for respondent bias.

Bottom line

Under an intensive care unit schedule compliant with the 16-hour limit, PGY-1 residents reported minor increases in sleep, increased restfulness, and increased satisfaction with their educational experience.

Results

From February 2011 through June 2011, a total of 1162 surveys were sent to 43 PGY-1 internal medicine residents during critical care rotations at BIDMC. Of these, 362 (31.2%) were returned. From February 2012 through June 2012, a total of 1305 surveys were sent to 41 PGY-1 internal medicine residents during critical care rotations at BIDMC. Of these, 290 (22.2%) were returned. See TABLE 1 for participant and shift characteristics.

For the period before the duty hour scheduling change, 57.7% (209 of 362) of PGY-1 residents scheduled on a critical care rotation reported receiving 6 hours or more of sleep in a 24-hour period, compared to 72.4% (210 of 290) of residents after the scheduling change (adjusted relative risk [RR], 1.33; 95% CI, 1.15–1.53; TABLE 2). When we assumed that missing surveys had a cumulatively null effect and added these to the returned surveys, we continued to observe a significant pooled RR of 1.08 (95% CI, 1.01–1.17). When analyzed as a continuous variable there was a significant difference in mean amount of sleep between the 2 groups (6.5 versus 5.9 hours in the postintervention and preintervention groups, respectively; adjusted difference of 0.83 hours of sleep per 24-hour period; 95% CI, 0.28–1.38).

Residents in the postintervention group had significantly greater odds of reporting increased restfulness than those in the preintervention group (adjusted odds ratio [OR], 1.62; 95% CI, 1.01–2.60). They also had significantly increased odds of reporting greater satisfaction with educational quality (adjusted OR, 2.59; 95% CI, 1.40–4.81).

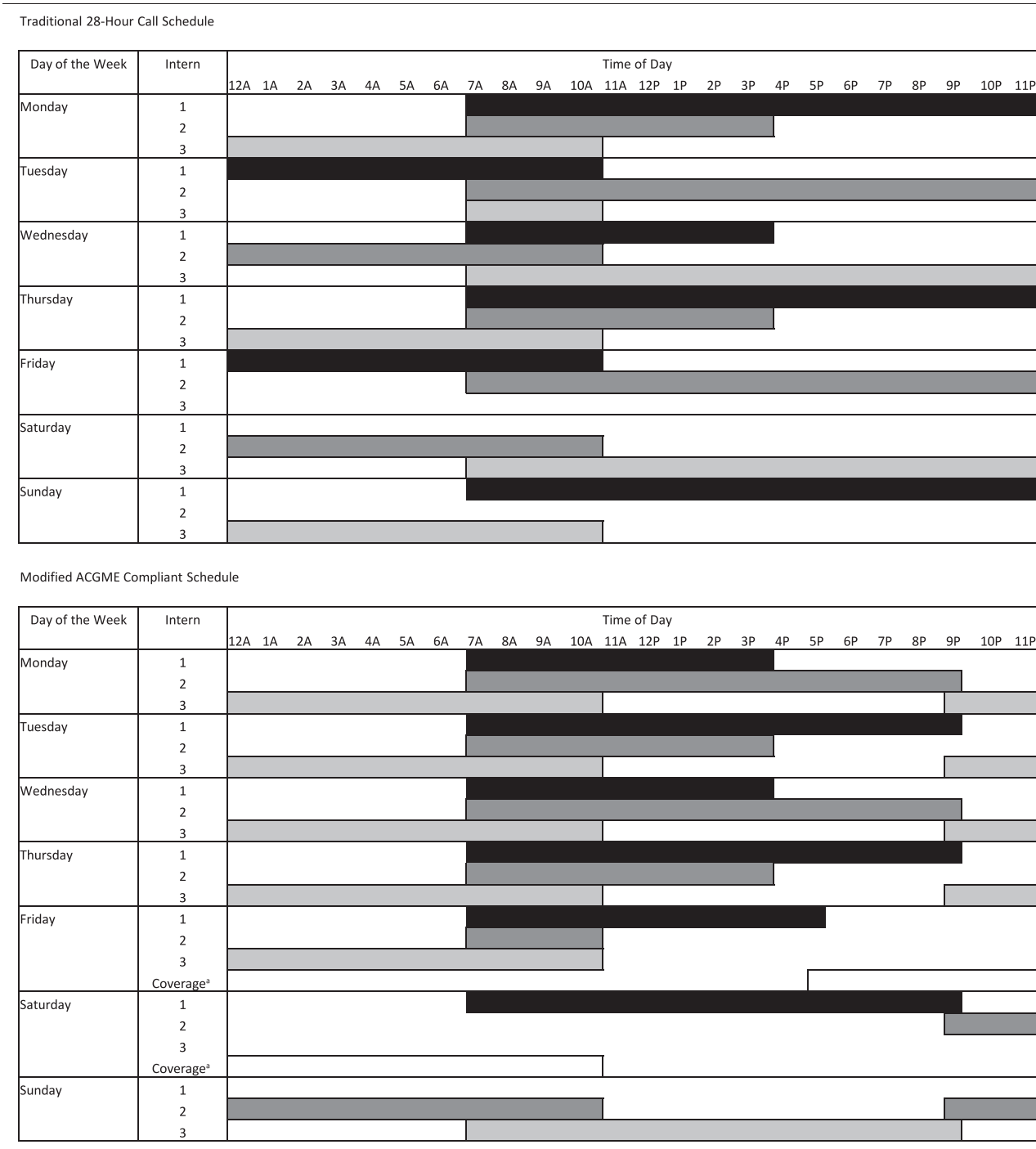

FIGURE **Intensive Care Unit Scheduling Before and After Duty Hour Regulation Changes**

[a] Friday-Saturday coverage was provided by covering PGY-2 and-3 residents.

Discussion

During the year following elimination of ICU shifts lasting longer than 16 hours, PGY-1 internal medicine residents were more than 30% more likely to report receiving more than 6 hours of sleep than those PGY-1 residents from the year prior. We observed concurrent improvement in reported restfulness and perceived educational quality.

If ACGME duty hour regulations were aiming to create environments that support increased PGY-1 resident sleep, our program's results demonstrate some success but also some reason for ongoing concern. Although we found that

TABLE 1 **Demographics**

	Preintervention, No. (%) N = 1161	Postintervention, No. (%) N = 1305	*P* Value
Surveys received	362 (31.2)	290 (22.2)	< .001
Women	169 (46.7)	113 (39.0)	.05
February	139 (38.4)	101 (34.8)	.34
March	88 (24.3)	37 (12.8)	< .001
April	83 (22.9)	39 (13.4)	< .01
May	19 (5.2)	79 (27.2)	< .01
June	33 (9.1)	34 (11.7)	.28
MICU No. 1	80 (22.1)	60 (20.7)	.66
MICU No. 2	162 (44.8)	121 (41.7)	.44
CCU	120 (33.2)	109 (37.6)	.24

Abbreviations: MICU, medical intensive care unit; CCU, critical care unit.

TABLE 2 **Outcomes**

	Preintervention, No. (%)	Postintervention, No. (%)	*P* Value	Relative Risk[a] (95% CI)
	n = 362	n = 290		
Reported quantity of sleep				
< 6 h/night	153 (42.3)	80 (27.6)	< .001	1.33 (1.15–1.53)
≥ 6 h/night	209 (57.7)	210 (72.4)		
				OR[a] (95% CI)
Which of the following statements most closely describes your sleep last night?	n = 362	n = 290		
When I woke up I felt like I had gotten too much sleep.	4 (1.1)	9 (3.1)	< .001	1.62 (1.01–2.60)
When I woke up I felt I had gotten sufficient sleep.	114 (31.5)	91 (31.4)		
When I woke up I felt I could have used more sleep.	175 (48.3)	164 (56.6)		
When I woke up I felt just as tired or even more tired than I did when I went to sleep.	46 (12.7)	25 (8.6)		
I did not sleep	23 (6.4)	1 (0.3)		
I am satisfied overall with the quality of the education I received in the last 24 h	n = 256	n = 271		
I strongly agree	20 (7.8)	51 (18.8)	.004	2.59 (1.40–4.81)
I agree	159 (62.1)	169 (62.4)		
I neither agree nor disagree	62 (24.2)	39 (14.4)		
I disagree	15 (5.9)	11 (4.1)		
I strongly disagree	0	1 (0.4)		

Abbreviation: OR, odds ratio.

[a] Adjusted for sex, intensive care unit location, and month of the year.

PGY-1 residents in the postintervention group received more sleep, 27.6% (80 of 290) of respondents still reported obtaining fewer than 6 hours of sleep in any given 24-hour period, and the total quantity of sleep only increased by less than 1 hour per night. In this respect, our results are consistent with 2 of the other significant implementation trials to date.[8,10] Lockley et al[8] and Auger et al[10] each found that after implementing similar duty hour restrictions, the percentage of interns who reported sleeping longer than 5 to 6 hours in any given 24-hour period increased, but remained below 80%. When considered with our findings, this suggests the presence of external factors affecting the quantity of resident sleep. One could hypothesize that sleep is just 1 of many factors, along with academic work, family time, and social activities, competing for a resident's nonclinical time. There is a paucity of published literature regarding the effect of such nonclinical variables on physician sleep. Of note, no regulations mandate residents to sleep when away from the hospital.[14]

Following the schedule changes residents were also 60% more likely to report improved restfulness. We attribute this to the clinical significance of the perceived change in sleep: 0.83 extra hours of sleep per 24-hour period translates to almost 6 additional hours of sleep per week, a substantial amount for a resident working close to 80 hours per week (actual number of hours worked was not collected for this study).

Surveys of residency directors and ICU clinicians have raised concerns that recent duty hour changes may adversely affect graduate medical education.[15–17] Preserving educational opportunities was thus an important aim of our scheduling changes, which allowed for attendance at morning didactics by all members of the ICU team regardless of position in the call cycle. We found increased satisfaction with the quality of education in the postintervention period, despite no known changes in the content or structure of the daily 1-hour morning didactic sessions.

This study has several limitations. First, our response rate was poor and was significantly different between study periods. However, we performed a sensitivity analysis assuming a null effect among nonresponders and found that our primary results on self-reported quantity of sleep were robust even to this conservative assumption. Paradoxically, our response rate decreased after 2011 despite interns ostensibly having more time away from the hospital. Although this might reflect greater stress or time urgency in the new ICU model, it might also stem from the program's success. We speculate that better rested interns may have felt less urgency to respond to a survey about sleep issues.

Second, we only examined PGY-1 residents. As recent literature suggests that duty hour regulations may be shifting junior-level responsibilities to more experienced residents, a concurrent survey of PGY-2 and PGY-3 residents may have demonstrated different results.[18] Our survey measurement, chosen over preexisting sleepiness scales (eg, Epworth, Stanford) for its relative brevity, has not been validated. Although prior research has demonstrated a strong correlation between reported and actual sleep in resident physicians, responders may not have interpreted questions, especially those related to quality of sleep, as intended, or differently from each other.[8] Furthermore, our study was performed at a single institution, which may limit its generalizability, and occurred in the ICU, where the relationship between continuity of care and learning may be different than in other settings. Finally, we recognize the possibility of confounding by underlying temporal trends not accounted for by our model.[18]

Conclusion

The schedule changes for PGY-1 residents made in response to the 2011 ACGME duty hour revisions were associated with increased resident self-reported sleep, restfulness, and satisfaction with educational quality.

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