

Internal Medicine Residents' Clinical and Didactic Experiences After Work Hour Regulation

A Survey of Chief Residents

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BACKGROUND: Work hour regulations for house staff were intended in part to improve resident clinical and educational performance.

OBJECTIVE: To characterize the effect of work hour regulation on internal medicine resident inpatient clinical experience and didactic education.

DESIGN: Cross-sectional mail survey.

PARTICIPANTS: Chief residents at all accredited U.S. internal medicine residency programs outside New York.

MEASUREMENTS AND MAIN RESULTS: The response rate was 62% (202/324). Most programs (72%) reported no change in average patient load per intern after work hour regulation. Many programs (48%) redistributed house staff admissions through the call cycle. The number of admissions per intern on long call (the day interns have the most admitting responsibility) decreased in 31% of programs, and the number of admissions on other days increased in 21% of programs. Residents on outpatient rotations were given new ward responsibilities in 36% of programs. Third-year resident ward and float time increased in 34% of programs, while third-year elective time decreased in 22% of programs. The mean weekly hours allotted to educational activities did not change significantly (12.7 vs 12.4, $P=.12$), but 56% of programs reported a decrease in intern attendance at educational activities.

CONCLUSIONS: In response to work hour regulation, many internal medicine programs redistributed rather than reduced residents' inpatient clinical experience. Hours allotted to educational activities did not change; however, most programs saw a decrease in intern attendance at conferences, and many reduced third-year elective time.

KEY WORDS: internship and residency; workload; education; personnel staffing; scheduling.

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Prompted by concern over patient safety and resident well-being as well as mounting pressure from Congress and OSHA,^{1,2} the Accreditation Council for Graduate Medical Education (ACGME) instituted work hour limitations for residents on July 1, 2003.³ Compliance with the regulations has been high: the ACGME found that only 3.3% of house staff reported working more than 80 hours a week after work hour regulations were implemented.⁴

A major justification cited by the ACGME for instituting duty hour limits was the potential for adverse resident "clinical

and educational performance" resulting from fatigue.⁵ As the steps that programs take to comply with work hour limits may have broad ramifications beyond reducing resident fatigue, the full impact of the regulations on residents' opportunities for clinical experience and formal education is important to assess.^{6,7} Only a handful of studies of internal medicine residents at single institutions have evaluated aspects of these issues after the ACGME regulations.⁸⁻¹¹

We conducted a survey of chief residents to evaluate national changes in internal medicine residents' clinical and didactic experience after work hour regulations were instituted.

METHODS

Participants

We identified all 386 ACGME-accredited internal medicine residencies by searching the Fellowship and Residency Electronic Interactive Database (FREIDA) for internal medicine residencies. We excluded the 60 New York State residency programs because New York had been subject to more stringent regulations since 1989.¹² Two additional programs were excluded because they were not active before 2003. The final eligible study population thus comprised 324 programs. We contacted chief residents at each site because they had both administrative expertise and first-hand experience of any changes, having been residents before and after work hour regulation. The Yale Human Investigation Committee approved the study and granted a waiver of signed informed consent to preserve anonymity of respondents.

Information on program size, geographic region, and practice setting for the study sample was obtained from FREIDA and the ACGME website; however, information on practice setting was missing for 69 programs. We used FREIDA criteria to define program size as a categorical variable with 3 levels based on number of residents (<30, 30 to 50, >50), geographic setting as a categorical variable based on U.S. Census regions, and practice setting as a categorical variable with 5 levels (university-based, community-based and university-affiliated, community-based, military, and other).

Survey

The survey instrument was created by the study investigators and pilot tested for clarity and content by 15 physicians, including 6 who had recent experience as chief residents.

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The final questionnaire included sections on clinical experience, didactic experience, and transfers of care. This report describes the results of the clinical and didactic portions of the survey.

First, we asked whether programs made any changes in their schedules because of the new work hour regulations. To assess weekly inpatient experience, we asked about changes in number of patients admitted on long call, number admitted on other days, and average caseload per intern. Possible responses to these questions were "decreased," "no change," or "increased." Although we did not define it in the survey, long call is generally understood to be the day on which house staff may admit the most patients.

To assess yearly clinical experience, we inquired about changes in time assigned to the wards ("ward coverage") during call-free rotations, for which possible responses were "decreased," "no change," or "increased." In addition, open-ended questions requested the specific number of ward, float, and elective rotations in each year of training before and after regulations were instituted. A rotation was defined as a month or a 4-week block. For ward rotations, time spent in the hospital caring for patients, the survey excluded time spent in the intensive care unit, on a consult service, or on a float service. A float rotation is one in which an intern or resident is specifically assigned to care for patients of teams not in the hospital, either during the day or at night. For elective rotations, during which residents can choose their own activities, the survey excluded required "electives" such as neurology or geriatrics. When provided, we accepted fractional rotation responses (i.e., 2 weeks of float was defined as 0.5 float rotations).

The didactic portion of the survey included questions about hours allotted to formal education before and after any schedule change, and percent attendance by interns and residents before and after any schedule change.

Questionnaires were mailed in March 2005, and re-sent twice at 2-week intervals to nonresponders. After the third mailing, the principal investigator (L.I.H.) called all remaining nonresponders. Questionnaires were self-administered and we asked for 1 response by a chief resident per program. When we received more than 1 response from a residency program, we included only the more complete questionnaire, or, if equally complete, the first received. The survey could be completed on paper or on-line. A lottery for a \$100 Amazon.com gift certificate was a financial incentive for participation.

Statistical Analysis

Differences between respondents and nonrespondents were analyzed using χ^2 tests. We used descriptive statistics to describe changes in weekly clinical experience. Changes in yearly clinical and didactic experiences were analyzed using *t*-tests for paired data. Programs that reported having no schedule changes were imputed to have no change in yearly clinical experience if they did not report full before/after data for this section. We combined ward and float time in the yearly analysis because we sought to determine whether total time spent on the wards (in any capacity) had changed after work hour regulation. In addition, because we hypothesized that programs that added float rotations might sacrifice elective rotations, we prespecified a subgroup analysis by addition of float rotations. We defined programs that added float rotations

("float programs") as those that increased the number of float rotations after work hour regulations. For this analysis, we used χ^2 tests to test differences in weekly clinical experience between subgroups. To test differences in yearly clinical and didactic experiences between subgroups, we used *t*-tests. An α of 0.05 was used for assessing statistical significance; all statistical tests were 2-tailed.

RESULTS

We received surveys from 202 of the 324 eligible residency programs (62%). There was no significant difference in size, geographic setting, or practice setting between respondents and nonrespondents (Table 1). Respondents with missing data for an outcome were excluded from analysis of that outcome only; the average rate of missing data for outcomes in this analysis was 11% (range 4 to 19). Eighty percent of chief residents (155/194) reported that their programs had changed their schedules to comply with work hour rules. There was no significant difference between programs that changed schedules and those that did not in baseline time allotted to ward, float or elective for any residency class, or in baseline didactic time or attendance before work hour regulations.

Weekly Clinical Experience

Responses to the weekly clinical experience questions are shown in Table 2. The majority (72%) of programs (137/191) reported no change in average patient load per intern. However, 48% of programs (92/193) reported a redistribution of admissions across the call cycle. Thirty-one percent (59/193) decreased the number of patients admitted per intern on long call, and 21% (41/193) increased the number of patients admitted per intern on other days. Nine percent of programs (17/191) reported that ancillary services to assist in workload completion were more available after work hour regulation.

Of the 163 programs providing complete before/after information on float rotations, 78 (48%) added a float rotation after work hour regulations. Programs that added a float

Table 1. Demographic Characteristics of Respondents and Nonrespondents

	Respondents (N=202)	Nonrespondents (N=122)	P Value
Size of program, N (%)			.59
<30 residents	44 (22.0)	32 (25.8)	
30 to 50 residents	68 (34.0)	44 (35.5)	
>50 residents	88 (44.0)	48 (38.7)	
Program setting, N (%)*			.82
University hospital	55 (34.6)	33 (34.4)	
Community hospital, university affiliated	64 (40.3)	37 (38.5)	
Community hospital	22 (15.7)	19 (19.8)	
Military hospital	7 (4.4)	2 (2.1)	
Other	8 (5.0)	5 (5.2)	
Program location by census region, N (%)			.14
Midwest	55 (27.4)	31 (25.0)	
Northeast	49 (24.4)	34 (27.4)	
South	61 (30.4)	34 (27.4)	
West	34 (16.9)	18 (14.5)	
Territory	2 (1.0)	7 (5.7)	

*Data not available for 69 programs.

Table 2. Percent of Programs Reporting Changes in Workload After Work Hour Limitations (N=193)

	Decreased (%)	No change (%)	Increased (%)
Admissions per intern, long call	31	64	6
Admissions per intern, other days	10	68	21
Patients per intern, average census	20	72	8
Ancillary services	0	91	9
Ward coverage during call-free rotations	8	56	36

Percents may not sum to 100 because of rounding.

rotation (“float programs”) did not differ from those that did not (“nonfloat programs”) in terms of changes in average patient load, admissions on nonlong call days, and ancillary services. Float programs were more likely to have an increase in admissions on long-call days than nonfloat programs (12% [9/78] vs 1% [1/85], $P=.02$), although in both groups this was rare.

Yearly Clinical Experience

Programs that made changes for house staff in ward and float or elective time most often decreased elective time and increased ward and float time. The mean changes and distributions of changes in ward and float time for each class are shown in Table 3. Data for elective time are shown in Table 4. In addition, after work hour regulation, 36% of programs (70/193) required more ward coverage from residents during their “call-free” rotations (such as elective or outpatient).

House staff in nonfloat programs saw no significant change in time allotted to ward and float or elective rotations. However, in float programs, combined ward and float time increased after work hour regulation for all 3 residency classes. For interns, the mean increase was 0.2 months (95% confidence interval [CI], 0.03 to 0.4; $P=.03$), 0.7 (95% CI, 0.5 to 0.8; $P<.0001$) for second-year residents, and 0.8 (95% CI, 0.6 to 1.0; $P<.0001$) for third-year residents. The difference between float and nonfloat programs was statistically significant ($P<.005$ for each residency class). Similarly, elective time in float programs decreased by 0.3 months (95% CI, -0.5 to -0.2 ; $P<.0001$) for second-year residents, and by 0.3 months (95% CI, -0.5 to -0.1 ; $P=.002$) for third-year residents. The difference between float and nonfloat programs was statisti-

Table 3. Percent of Programs Reporting Changes and Mean Changes in Ward and Float Time After Work Hour Regulation (N=161)

	PGY-1	PGY-2	PGY-3
Any decrease	11	6	3
No change	70	58	62
Increase < 1 mo	3	7	7
Increase 1 mo	12	19	18
Increase > 1 mo	4	9	9
Mean change, mo (mean ± SD)	0.04 ± 0.80	0.32 ± 0.69*	0.38 ± 0.70*

Percents may not sum to 100 because of rounding. SD, standard deviation; PGY, postgraduate year.

* $P<.001$ for change after work hour regulation.

Table 4. Percent of Programs Reporting Changes and Mean Changes in Elective Time After Work Hour Regulation (N=165)

	PGY-1	PGY-2	PGY-3
Decrease > 1 mo	1	3	6
Decrease 1 mo	6	13	12
Decrease < 1 mo	1	5	4
No change	82	71	72
Any increase	11	8	6
Mean change, mo (mean ± SD)	0.25 ± 0.45 – 0.13 ± 0.58* – 0.17 ± 0.63†		

Percents may not sum to 100 because of rounding. SD, standard deviation; PGY, postgraduate year.

* $P=.004$ for change after work hour regulation.

† $P<.001$ for change after work hour regulation.

cally significant (second-year residents, $P=.0004$; third-year residents, $P=.05$). Float programs were also more likely than nonfloat programs to have increased ward coverage during call-free rotations (53% vs 27%, $P=.004$) after work hour regulation.

Didactic Experience

There was no significant change in hours dedicated to formal educational activities before and after work hour limitations (12.7 [IQ range 10 to 15] vs 12.4 [IQ range 10 to 15], $P=.12$). Overall reported intern attendance at educational activities decreased an average 5.0% (95% CI, -6.8 to -3.1 ; $P<.0001$) after work hour limitations, from 71.1% to 66.1%. In 38% of programs, the reported decrease was 10% or more. Resident attendance decreased an average 4.0% (95% CI, -5.7 to -2.5 ; $P<.0001$), from 76.7% to 72.7%. The reported decrease was 10% or more in 31% of programs.

Educational activity attendance for interns did not differ significantly between float and nonfloat programs. However, float programs reported significantly lower attendance at educational activities by residents after work hour limitations (decrease of 6%) than nonfloat programs (decrease of 2%, $P=.02$).

DISCUSSION

In this study, we found that inpatient care experience, as represented by number of patients admitted, was generally redistributed rather than substantively decreased after work hour regulation. However, we found that a substantial minority of residency programs reduced elective opportunities for third-year residents and increased their ward and float time, raising concern that the breadth of clinical experience may have changed. Similarly, although we found no significant change in hours allotted to formal educational activities after work hour regulations were instituted, over half of the respondents reported a decrease in intern attendance at educational activities, and a quarter reported a decrease equivalent to 2 hours a week or more. This raises some concern about the impact of work hour regulation on residents’ educational experience.

Given the financial and staffing constraints on most academic medical centers and the cost of hiring ancillary personnel,¹³ we were not surprised to find that programs have redistributed rather than relinquished work. This

may be reassuring to those concerned about decreased volume of inpatient clinical experience in the postwork hour environment and is consistent with findings in other specialties.^{14–18}

Studies of educational attendance in internal medicine residencies after work hour regulation are also consistent with our findings.^{8–11,19} Nonetheless, decreased attendance at educational activities does not necessarily translate to decreased knowledge.²⁰ The quality of attention paid during conferences may improve with rest or a change in scheduling, as has been shown in the intensive care unit.^{21,22} In addition, some internal medicine studies have shown an increase in independent reading after work hour regulations,^{8,11} which may positively influence educational performance.

Nearly half the programs added float rotations after work hour regulations were instituted. A subgroup analysis of our data showed that the programs most affected by loss of elective time, increased time on the wards, and decreased attendance at educational activities were those programs that instituted float rotations. This increase in ward and float time was not merely because of the addition of float rotations. If float rotations were added in exchange for ward time, net ward and float time would have been constant. However, the significant increase in ward and float time shows that these rotations were often added at the cost of outpatient or elective time. Potential costs of float rotations should therefore be weighed against their benefits^{23–26} by programs contemplating this solution to work hour regulation.

Our reasonable response rate and the demographic similarity of respondents to nonrespondents are reassuring in terms of possible response bias, but it is still possible that respondents were systematically different from nonrespondents. Some questions (such as whether attendance at didactic sessions had changed) required judgment on the part of the chief resident. Answers to these questions might have been affected by bias either in favor of or against work hour limitations. In addition, reports of change over time may be subject to recall bias. We believe this to be mitigated by the fact that this group of chief residents was intimately involved in the program both before and after work hour regulations.

The open-ended comments we received suggest several areas for further research. Several respondents commented on adverse effects on clinical and educational performance created by decreased continuity of care. Systematic data on changes in continuity are not yet available. Some respondents described the creation of nonteaching services to allow house staff to focus on fewer (or sicker) patients, and others reported restructuring rotations to exclude some types of clinical experience in order to be able to staff the general wards. More careful investigation into the diversity, rather than volume, of residents' experience may therefore be warranted. Finally, some respondents to our survey commented that postcall ambulatory clinics were eliminated without replacement on other days; this was also supported by a recent study.²⁷ Ambulatory medicine is an important component of residency education and the effect of work hour regulations on the outpatient experience for both residents and patients should be fully assessed.

In summary, we found that many programs responded to work hour limits by redistributing resident workload throughout the workweek, across rotations, and over the 3 years of training, with larger changes in programs that added float ro-

tations. We found some cause for concern in reports of decreased elective time and conference attendance, but we also identified many programs that were able to comply with work hour regulations without these adverse effects. As more research is conducted into strategies for reducing resident work hours, it may be possible to identify the best methods of complying with work hour regulations while protecting the main mission of residency programs: training excellent physicians.

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