

# Impact of Duty-Hour Restriction on Resident Inpatient Teaching

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**BACKGROUND:** Education and patient care are essential to academic hospitalists, and residents are key partners in these goals. The Accreditation Council for Graduate Medical Education (ACGME) duty-hour restrictions (DHR) likely impacted aspects of resident teaching, well-being, and patient care practices that affect the duties of academic hospitalists.

**OBJECTIVE:** To determine the impact of DHR on resident teaching time and the factors associated with, and impacts of, time spent teaching.

**DESIGN:** Cross-sectional survey.

**SETTING AND MEASUREMENTS:** A total of 164 internal medicine residents at University of California, San Francisco (UCSF), San Francisco, CA were queried regarding their time spent teaching, completion of administrative tasks, number of hours worked, frequency of emotional exhaustion, and satisfaction with quality of patient care provided after DHR. Regression analyses identified factors associated with decreased teaching time and determined that there were associations between time spent teaching, emotional exhaustion, and satisfaction with quality of patient care.

**RESULTS:** A total of 125 residents (76%) responded; 24% reported spending less time teaching. Less time teaching was associated with being a postgraduate year (PGY)-2 (odds ratio [OR], 7.14; 95% confidence interval [CI], 1.56-32.79) or PGY-3 (OR, 8.23; 95% CI, 1.44-47.09), reporting working <80 hours/week (OR, 5.99; 95% CI, 1.11-32.48) and spending a greater percentage of time on administrative tasks (OR, 1.03; 95% CI, 1.00-1.06). Those residents who spent less time teaching also reported less frequent emotional exhaustion ( $P = 0.003$ ) and more satisfaction with quality of care ( $P = 0.006$ ).

**CONCLUSIONS:** DHR has decreased teaching time for some residents, and those residents are more likely to be less emotionally exhausted and deliver self-perceived higher quality of care. Academic hospitalists should consider these impacts of DHR and make adjustments such as educational and work-life innovations to account for these shifts. *Journal of Hospital Medicine* 2009;4:476-480. © 2009 Society of Hospital Medicine.

**KEYWORDS:** duty hours, hospitalist, resident, teaching.

Hospital medicine is the fastest growing specialty in the history of medicine, and nearly 20% of hospitalists work in academic settings.<sup>1</sup> Academic hospitalists often wear many hats; one of their main responsibilities is to supervise and teach residents and students. Hospitalists have responded to a number of changes to the landscape of medicine over the last 5 years, but none has had a more profound impact on an academic hospitalist's clinical teaching duties than the mandated reduction in duty hours (duty-hour restrictions [DHR]).

In 2003, the Accreditation Council for Graduate Medical Education (ACGME) limited resident duty hours to 80 per week with no more than 30 consecutive hours,<sup>2</sup> as a response to concerns about the impact of long duty hours on resident education, well-being, and patient safety and pressures from impending legislation.<sup>3,4</sup> Data suggest many positive outcomes of these mandates,<sup>5-10</sup> but one unfore-

seen consequence may be diminished time residents spend on teaching.<sup>11-14</sup>

Academic hospitalists partner with residents to provide care and contribute to the learning of the medical team. The time spent teaching has many merits for residents, as they are valuable teachers of medical students<sup>15</sup> and many find teaching enjoyable.<sup>16</sup> Teaching also increases residents' own medical knowledge.<sup>17</sup>

Previous studies have demonstrated that some residents report teaching less since DHR.<sup>11,13</sup> Furthermore, greater than 75% of faculty educators, specifically those in Internal Medicine where the majority of academic hospitalists practice, perceive that since DHR, residents are teaching less.<sup>13</sup> Given these concerns, and the benefits of resident teaching, it is important for academic hospitalists to understand the effects that DHR may have regarding the amount of time

residents spend teaching and its consequences, in order to respond to this shift in the educational landscape and ensure trainee education while delivering exemplary patient care.

To better understand the factors related to and impact of resident teaching time since DHR, we performed a cross-sectional survey of internal medicine residents at the University of California, San Francisco (UCSF). We hypothesize that workload elements of resident life are associated with the amount of time spent teaching. We also posit that the amount of time spent teaching may impact resident well-being and perceptions of patient care.

## Methods

### Sites and Subjects

Descriptions of the survey protocol, including development and methods, have been published.<sup>11,18</sup> This study was performed at UCSF. The study was approved by the institutional review board at UCSF, and all 164 residents in internal medicine were eligible to participate. Data were collected beginning 1 month after DHR were implemented in February 2003 and collected for a total of 4 months.

### Survey Development

After reviewing the literature and observing the residents over 1 month, the investigators identified domains pertaining to resident workload, quality of life, and patient care practices. An open-ended question survey was created with questions regarding these domains, and given as a pilot survey to a group of residents ineligible for the study. Based on responses to the open-ended questions, the investigators then developed a set of closed-response items to the original questions. To establish content validity, the survey was reviewed by experts in medical education, outcomes research, and psychometrics, after which items were eliminated or reformatted if necessary. As a final check for usability and clarity, the survey was then pretested on non-internal medicine house-staff at the medical center and recent graduates of residency programs.

### Survey Measures

#### Demographics

Residents were asked to report their age ( $\leq 30$  or  $> 30$  years), sex, postgraduate year (PGY), and training program (primary care, categorical, or preliminary).

#### Teaching Time

Residents were asked, "compared to the same (or equivalent) inpatient rotation BEFORE February 2003, how much time did you spend teaching during your most recent inpatient rotation?" Answers rated on a 5-point scale, 1 being "much less," and 5 being "much more." Responses were dichotomized into "less" or "same or more" as described in the Results section.

#### Hours Worked

Residents were asked, "During your most recent inpatient rotation, how many hours did you work in 1 average week?" Possible answers: "50-59," "60-69," "70-79," "80-89," "90-99," and " $\geq 100$ ." Responses were dichotomized into " $< 80$ " or " $\geq 80$ ."

#### Time Spent on Nonphysician Administrative Tasks

Residents were asked to report, "What percent of your time is spent doing tasks that could be completed by a non-MD?" Answers ranging between "0" and "100%" were filled into a blank space by the resident.

#### Emotional Exhaustion

A single score defined as being emotionally overextended and exhausted by work. Constructed as the mean of two highly-correlated item responses (Cronbach's alpha = 0.84): "During your most recent workweek, how often did you feel overwhelmed at work?" and "During your most recent workweek, how often did you feel worn out?" Responses ranged from 1 ("never") to 5 ("very often").

#### Satisfaction with Patient Care

"During your most recent inpatient rotation workweek, how satisfied were you with the quality of patient care you provided?" Rated on a 10-point scale with 1 being "completely unsatisfied" and 10 being "completely satisfied."

#### Statistical Analyses

Univariate statistics were used first to characterize the distribution and frequency of the residents' responses. Bivariate associations among variables were assessed with correlation analyses and *t*-tests.

Three regression models were constructed. First, a multivariate logistic regression model identified factors independently associated with self-reported decreased teaching time. Variables were selected for the model based on prior hypotheses regarding factors related to decreased teaching time, observed relationships among variables, or to retain face validity of the model: age ( $\leq 30$  versus  $> 30$  years), sex, PGY (PGY1 versus PGY2, PGY3), program (primary care versus categorical), hours worked/week, and percentage of time spent on administrative tasks. Next, a linear regression model examined the relationship between teaching time and emotional exhaustion, controlling for age, sex, PGY, program, hours worked, and time spent on administrative tasks. Finally, a linear regression model determined which of the factors in the second model, plus emotional exhaustion, were independently associated with satisfaction with patient care. All variables were retained in each model.

## Results

### The Residents

Of 164 eligible residents, 125 (76%) returned the survey. Sex, PGY, and program were similar between respondents and

**TABLE 1. Characteristics of Residents**

Characteristic	Those Who Teach Same or More (n = 75)	Those Who Teach Less or Much Less (n = 24)	P Value*
PGY, n (%)			0.0013
PGY-1	41 (93.2)	3 (6.8)	
PGY-2	23 (63.9)	13 (36.1)	
PGY-3	11 (57.9)	8 (42.1)	
Training program, primary care, n (%)	29 (38.7)	6 (25.0)	0.33
Sex, female, n (%)	43 (57.3)	11 (45.8)	0.35
Age <30 years, n (%)	55 (75.3)	16 (66.7)	0.43
Number of hours worked <80, n (%)	43 (58.1)	22 (91.7)	0.002

Abbreviation: PGY, postgraduate year.

\*From chi-square analyses or *t*-tests comparing those who taught the same or more to those who taught less after institution of duty-hour restrictions.

nonrespondents ( $P > 0.2$ ,  $P > 0.45$ , and  $P > 0.6$ , respectively). Respondents were equally distributed among year of training, with 36.6% PGY-1, 35.8% PGY-2, and 27.6% PGY-3. Most respondents were female (60%), younger than age 30 years (70%), and enrolled in the categorical residency program (62%). All (100%) reported being aware of the system changes intended to reduce hours to <80 hours/week, and 35% reported working >80 hours/week after DHR. All PGY-1s had completed inpatient months prior to being surveyed.

### Factors Associated With Spending Less Time Teaching

Of the 126 respondents, 107 completed the question regarding time teaching; 8 “don’t know” responses were coded as missing, yielding an analytic n of 99 (60%). Twenty-four (24.2%) residents reported spending less (n = 21) or much less (n = 3) time teaching after DHR began. Because only three individuals reported “much less” teaching time after DHR, the group was not large enough to yield meaningful or stable analytic results, so the groups were combined. Bivariate comparisons between those who reported less teaching compared to those who reported the same or more are shown in Table 1.

In multivariate models, working <80 hours/week (odds ratio [OR], 5.99; 95% confidence interval [CI], 1.11-32.48), being a PGY-2 (OR, 7.14; 95% CI, 1.56-32.79) or PGY-3 (OR, 8.23; 95% CI, 1.44-47.09), and reporting more time on administrative tasks (OR, 1.03; 95% CI, 1.00-1.06) were associated with reports of spending less time teaching (Table 2).

### Impacts of Spending Less Time Teaching

In bivariate comparisons, residents who reported reduced teaching time were less emotionally exhausted ( $P = 0.006$ ) and more satisfied with the patient care they provided ( $P = 0.003$ ) (Table 3). In the multivariate analysis, emotional

**TABLE 2. Factors Associated with Reports of Spending Less Time Teaching**

Characteristic	OR (CI)
Number of hours worked <80	5.99 (1.11-32.48)
Age >30 years	0.91 (0.28-2.45)
Female	0.83 (0.28-2.45)
PGY-2	7.14 (1.56-32.79)
PGY-3	8.23 (1.44-47.09)
Primary care program	0.75 (0.22-2.51)
Time spent on nonphysician administrative tasks	1.03 (1.00-1.06)

Abbreviations: CI, confidence interval; OR, odds ratio; PGY, postgraduate year.

**TABLE 3. Impact of Spending Less Time Teaching on Resident Emotional Exhaustion and Satisfaction with the Quality of Patient Care**

	Time Spent Teaching		P Value
	Less or Much Less [Mean (SD)]	Same or More [Mean (SD)]	
Frequency of emotional exhaustion*	2.6 (0.8)	3.2 (0.9)	0.006
Satisfaction with patient care <sup>†</sup>	8.1 (1.2)	7.1 (1.8)	0.003

NOTE: Controlled for age, sex, PGY, program, number of hours worked, and time spent on administrative tasks.

Abbreviations: PGY, postgraduate year; SD, standard deviation.

\*1 = never, 5 = very often.

<sup>†</sup>1 = completely unsatisfied, 10 = completely satisfied.

exhaustion was significantly associated with satisfaction with patient care ( $\beta = -0.52$ ;  $P = 0.01$ ), but spending less time teaching was not ( $\beta = 0.32$ ;  $P = 0.46$ ). These analyses reveal that while there was a direct relationship between emotional exhaustion and satisfaction with patient care, the relationship between teaching time and satisfaction with patient care was mediated through emotional exhaustion.

### Discussion

In this cross-sectional survey of internal medicine residents, we found that roughly 25% of residents report spending less time teaching since DHR. Spending less time teaching was associated with working <80 hours/week, being PGY-2 or PGY-3 residents, and spending more time on administrative tasks. Residents’ reports of spending less time teaching were in turn associated with less emotional exhaustion and more satisfaction with the quality of patient care they provided.

As hospitalists have been shown to be more effective, and possibly better, teachers than nonhospitalists,<sup>19</sup> and are increasingly responsible for teaching duties on academic medical services,<sup>1</sup> our findings of some residents spending

less time teaching since DHR may necessitate changes in hospitalist teaching roles to adapt to this previously unrecognized shift. Although the majority of the residents in our cohort did not experience diminished teaching time, the educational impact of diminished teaching time for the quarter of our cohort that taught less frequently post-DHR is noteworthy, as these changes affect over 22,000 internal medicine residents. Our findings enhance previous work suggesting that DHR may have some negative effects on resident education.<sup>6-8,11-14,20</sup> We also found that those who spend less time teaching are more likely to be senior residents, the main teachers of medical students,<sup>21</sup> and therefore a reduction in time spent teaching may adversely impact medical students, as previously described.<sup>22</sup> Academic hospitalists, in order to maintain and ensure high levels of education and educational satisfaction in the post-DHR era will likely benefit from recognizing and responding to this change.

Our study also found that spending less time teaching was associated with fewer reports of emotional exhaustion and perceptions of higher quality patient care. Though residents enjoy teaching and would prefer to spend more time teaching if service responsibilities were fewer and if time allowed,<sup>16</sup> it is possible that when the total amount of time to accomplish tasks in a week or day are limited, spending time teaching may lead to increased stress and pressure, overwhelming residents and leading to increased emotional exhaustion. Less emotional exhaustion and higher perceptions of patient care are positive outcomes that are, in fact, aligned with the ACGME DHR goals<sup>2-4</sup> and are of prime importance to academic hospitalists as educators, role-models, and care providers.

Balancing the challenges of a reduction of time spent teaching and the possible benefits of the reduction will necessitate both individual and system-wide responses. Hospitalists are uniquely poised to develop these responses, which will likely have widespread impacts not only in education but also in patient care and satisfaction with the inpatient experience. Some of these responses may include teaching innovations, such as honing skills for brief teaching, incorporating focused, patient-driven teaching and emphasizing teachable moments,<sup>23-25</sup> or workflow innovations, including decreased administrative tasks for residents or changes to the workday schedule to enhance protected teaching time. Hospitalists may also need to increase their time contribution to teaching the medical team or structure more planned didactic sessions for residents and students to ensure that educational sessions are occurring.

Many new hospitalists were trained during duty hour limitations, but the majority were not.<sup>1</sup> The landscape of teaching on the medical wards since DHR is dramatically different, speckled with the discontinuities of multiple cross-coverage residents.<sup>26</sup> Residents may have unconsciously acclimated to the system change, and our findings, which give a time-specific glimpse of the changes that took

place with DHR, may inform some of the reasons behind the educational concerns of late.

Our study has several limitations. As a cross-sectional study, we describe associations and cannot discern causal pathways, but we believe that these associations themselves enhance our understanding of the consequences of DHR. We relied upon self-reports of teaching time, which are subject to bias. These self-reports, however, give insight into the resident's perspective of their experience, which is, in and of itself, noteworthy. This study is also subject to recall bias, and we attempted to minimize this by administering the survey just after DHR was implemented and by carefully framing the comparisons. Findings may be sensing secular events such as the challenges of a large system change or a difficult ward month. That said, our findings are consistent with other current survey studies of resident teaching time,<sup>11-14</sup> thus validating many of the conclusions from our collected data. As the survey was given shortly after DHR, it may not have accounted for initial obstacles of the new system; however, the survey was given over 4 months following DHR implementation at our institution, which we believe allowed the residency program time to adjust to the new organizational system while allowing for real-time feedback. Our study was conducted at a single site; however, because the medical system studied is comprised of three hospitals, each of which used a variety of "dayfloat" and "nightfloat" interventions similar to systems at other institutions, we believe the variability within our system increases the generalizability of this study to other institutions. Finally, these data were collected in 2003, and since that time, programs have likely made significant adjustments in their rotation schedules and team structure and may look different now than previously. We believe that the timing of this study adequately characterizes the potential loss of teaching time pre-DHR and post-DHR in a way that current data cannot, due to resident acclimatization to culture change, and therefore may better inform hospitalists regarding changes that may be implicit as opposed to explicit in resident teaching.

In conclusion, DHR has resulted in profound changes in teaching hospitals. Since education and patient care are central to the mission of academic hospitalists, they need to be aware of the potential for diminished teaching time by some of their residents, the factors that effect that change, and its impact on patient care. Hospitalists can use this information to create new systems of care delivery and education to optimize the resident and patient experience. As the duty hour issue has come again to the forefront, with the new Institute of Medicine Committee on Optimizing Graduated Medical Trainee (Resident) Hours and Work Schedules to Improve Patient Safety recommendations policies regarding duty hours,<sup>27</sup> it is keenly important that hospitalists understand the potentially unforeseen consequences of DHR on important aspects of resident work such as teaching.

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### References

1. Society of Hospital Medicine (SHM). 2008. *2007-2008 SHM Bi-Annual Survey: The Authoritative Source on the State of the Hospital Medicine Movement*. Philadelphia, PA: Society of Hospital Medicine.
2. Accreditation Council for Graduate Medical Education. Resident Duty Hours Common Program Requirements. Available at: [http://www.acgme.org/acWebsite/dutyHours/dh\\_dutyHoursCommonPR.pdf](http://www.acgme.org/acWebsite/dutyHours/dh_dutyHoursCommonPR.pdf). Accessed December 2008.
3. Philibert I, Friedmann P, Williams W; ACGME Work Group on Resident Duty Hours. Accreditation Council for Graduate Medical Education. New requirements for resident duty hours. *JAMA*. 2002;288(9):1112-1114.
4. Vidyarthi AR, Auerbach AD, Wachter RM, Katz PP. The impact of duty hours on resident self reports of errors. *J Gen Intern Med*. 2007;22(2):205-209.
5. Goitein L, Shanafelt TD, Wipf JE, Slatore CG, Back AL. The effects of work-hour limitations on resident well-being, patient care, and education in an internal medicine residency program. *Arch Intern Med*. 2005;165(22):2601-2606.
6. Gopal R, Glasheen JJ, Miyoshi TJ, Prochazka AV. Burnout and internal medicine resident work-hour restrictions. *Arch Intern Med*. 2005;165(22):2595-2600.
7. Lin GA, Beck DC, Stewart AL, Garbutt JM. Resident perceptions of the impact of work hour limitations. *J Gen Intern Med*. 2007;22(7):969-975.
8. Mathis BR, Diers T, Hornung R, Ho M, Rouan G. Implementing duty hour restrictions without diminishing patient care or education. *Acad Med*. 2006;81(1):68-75.
9. Horwitz LI, Kosiborod M, Lin Z, Krumholz HM. Changes in outcomes for internal medicine inpatients after work-hour regulations. *Ann Intern Med*. 2007;147:97-103.
10. Shetty KD, Bhattacharya J. Changes in hospital mortality associated with residency work hour regulations. *Ann Intern Med*. 2007;147:73-80.
11. Vidyarthi AR, Katz PP, Wall SD, Wachter RM, Auerbach AD. Impact of reduced duty hours on residents' educational satisfaction at the University of California, San Francisco. *Acad Med*. 2006;81(1):76-81.
12. Kogan JR, Pinto-Powell R, Brown LA, Hemmer P, Bellini LM, Peltier D. The impact of resident duty hours reform on the internal medicine core clerkship: results from the clerkship directors in internal medicine survey. *Acad Med*. 2006;81(12):1038-1044.
13. Zahn CM, Dunlow SG, Alvero R, Parker JD, Nace C, Armstrong AY. Too little time to teach? Medical student education and work-hour restriction. *Mil Med*. 2007;172(10):1053-1057.
14. Espey E, Ogburn T, Puscheck E. Impact of duty hour limitations on resident and student education in obstetrics and gynecology. *J Reprod Med*. 2007;52(5):345-348.
15. Bing-You RG, Sproul MS. Medical students' perceptions of themselves and residents as teachers. *Med Teach*. 1992;14:133-138.
16. Greenberg LW, Goldberg MR, Jewett LS. Teaching in the clinical setting: factors influencing residents' perceptions, confidence and behavior. *J Med Educ*. 1984;18:360-365.
17. Apter A, Metzger R, Glassroth J. Residents' perceptions of their role as teachers. *J Med Educ*. 1988;63:900-905.
18. Vidyarthi A, Auerbach A, Wachter R, Katz P. The impact of duty hours on resident self reports of errors. *J Gen Intern Med*. 2007;22(2):205-209.
19. Hauer KE, Wachter RM, McCulloch CE, Woo GA, Auerbach AD. Effects of hospitalist attending physicians on trainee satisfaction with teaching and with internal medicine rotations. *Arch Intern Med*. 2004;164(17):1866-1871.
20. Lund KJ, Teal SB, Alvero R. Resident job satisfaction: one year of duty hours. *Am J Obstet Gynecol*. 2005;193(5):1823-1826.
21. Brown R. House staff attitudes toward teaching. *J Med Educ*. 1970;45(3):156-159.
22. Brasher AE, Chowdhry S, Hauge LS, Prinz RA. Medical students' perceptions of resident teaching: have duty hours regulations had an impact? *Ann Surg*. 2005;242(4):548-553.
23. Harrison R, Allen E. Teaching internal medicine residents in the new era. *J Gen Intern Med*. 2006;21:447-452.
24. Neher JO, Gordon KC, Meyer B, Stevens N. A five-step "microskills" model of clinical teaching. *J Am Board Fam Pract*. 1992;5(4):419-424.
25. Ferenchick G, Simpson D, Blackman J, DaRosa D, Dunnington G. Strategies for efficient and effective teaching in the ambulatory care setting. *Acad Med*. 1997;72(4):277-280.
26. Vidyarthi AR, Arora V, Schnipper JL, Wall SD, Wachter RM. Managing discontinuity in academic medical centers: strategies for a safe and effective resident sign-out. *J Hosp Med*. 2006;1(4):257-266.
27. Resident Duty Hours: Enhancing Sleep, Supervision, and Safety. Ulmer C, Wolman DM, Johns MME, eds. Committee on Optimizing Graduate Medical Trainee (Resident) Hours and Work Schedule to Improve Patient Safety, Institutes of Medicine. Washington, D.C. The National Academics Press, 2008.