# Resident Work-Hour Rules: A Survey of Residents' and Program Directors' Opinions and Attitudes

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## Abstract

**In July 2003, the Accreditation Council for Graduate Medical Education (ACGME) established nationwide guidelines for resident working environments and duty hours. Following these guidelines became a requirement for all accredited residency programs. Two years after implementation, we conducted a national survey to assess the opinions and attitudes of orthopedic residents and program directors toward the ACGME work-hour regulations and the effects of these regulations on resident education, resident quality of life, and patient care. Nine hundred seventy-six residents (30% response rate) and 85 program directors (56% response rate) completed the questionnaire. For resident education, junior residents were more likely than senior residents and program directors to perceive the work-hour regulations as having a positive effect on education. There was overall agreement among the 3 groups that resident quality of life had improved as a result of work-hour regulations. For patient care, junior residents viewed the new regulations positively for surgical training and patient care, whereas senior residents and program directors disagreed. This survey showed meaningful differences in the attitudes and opinions of junior residents, senior residents, and program directors toward the new ACGME work-hour regulations.**


On July 1, 2003, the Accreditation Council for Graduate Medical Education (ACGME) established nationwide guidelines regarding resident working environment and duty hours. The language of the rules provides for continuous resident and patient-care supervision by the faculty and for a limitation on duty hours. Specifically, work-hour limitations include:

1. Eighty hours of in-house activities per week, averaged over 4 weeks.
2. At least 1 continuous 24-hour period within 7 days free of any clinical or educational responsibilities, averaged over 4 weeks.
3. At least a 10-hour rest period between all daily duty periods and after in-house call.
4. In-house call no more frequent than every third night, averaged over 4 weeks.
5. Continuous on-site duty not exceeding 24 hours, with additional 6 hours allowed for transfer of continuity of care.

Implementation of ACGME rules grew out of 20 years of ACGME work-hour regulation and was influenced by increasing demands on residents, increased public opinion that long hours compromise patient care, additional data on the effects of sleep deprivation, and the possibility of governmental regulation.[1] The New York experience was the proving ground for duty hour limitations, as similar rules had been enacted by the New York State Department of Health in July 1989,[2] a direct result of the March 1984 death of Libby Zion—a death attributed to poor supervision of overfatigued residents.[3]

Considerable research has been done on the effects of long hours and sleep deprivation on resident performance.[4,5] Recently, a well-publicized study found that pediatrics residents' performance after a heavy-call rotation in vigilance, attention, and driving tasks was equivalent to that of residents on a light-call rotation but intoxicated with alcohol up to a blood alcohol concentration of 0.04% to 0.05%.[6] Although not definitive, these results suggest that clinical performance, especially in tasks that require sustained attention, is impaired in the setting of sleep deprivation. However, controversy exists as to the actual impact of limited work-hour limit on patient outcomes.[7,8]

The response of the orthopedic community to the new regulations has been mixed.[9-11] A survey of orthopedic residents and faculty in a residency program in New York state explored the effects of the work-hour regulations as implemented by the 405 commission.[12] On the basis of this assessment, we sought to expand the survey to include all orthopedic residents and program directors affected by the new rules implemented by ACGME. We wanted to conduct a national survey of the opinions and attitudes of orthopedic residents and program directors toward the effects of ACGME work-hour regulations on resident education, resident quality of life (QOL), and patient care.

## Materials and Methods

A modified version of a Likert-type attitudinal questionnaire previously administered by Barden and colleagues[13] and at our institution[12] was used in this study. A 34-item survey was designed: 29 of these questions were administered to residents, 32 to residency program directors (Appendices I, II). Two questions were unique to residents, 5 to program directors. The resident survey addressed perceived impact of work-hour regulations on resident education, resident QOL, and patient care. The director survey addressed perceived impact of the regulations on resident education, resident QOL, and patient care by asking the same questions as the residents, with several additional questions related to director assessment of resident knowledge and preparation. Both

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surveys included general demographic questions and questions regarding compliance with the regulations and modifications made to the program to accommodate the new rules.

After institutional review board approval was acquired, the survey was administered with a Web-based survey tool, www.surveymonkey.com. A mailing list was compiled, and invitations to complete the survey were e-mailed to 152 directors and 3120 residents. Nonresponders were sent 3 reminder e-mails at 3-week intervals.

To ensure confidentiality, all responses were stripped of identifying information before analysis—including e-mail addresses and names of training programs. The response to each attitudinal questions was graded on a 5-point scale: *strongly disagree* (1), *moderately disagree* (2), *no opinion* (3), *moderately agree* (4), and *strongly agree* (5). Mean values of responses to each of the attitudinal questions were compared among junior (second- or third-year) residents, senior (fourth- or fifth-year) residents, and program directors.

We asked residents and directors about the modifications made to the programs to accommodate the work-hour regulations. These modifications included using a night-float approach, hiring more personnel, converting to home call, decreasing number of rotations and/or affiliations, and decreasing the size of the teaching service.

Statistical analysis was performed with GraphPad Prism software (GraphPad Software Inc, San Diego, Calif). The mean answer for each question was compared with the hypothetical mean of 3 (corresponding to *no opinion* on our Likert scale) using the 1-sample *t* test. Differences between median answers of different groups of responders were evaluated with nonparametric 1-way analysis of variance (ANOVA; Kruskal-Wallis test) and then the Dunn posttest, and the nonparametric *t* test (Mann-Whitney *U* test) when appropriate. A *P* value of less than .05 was accepted as statistically significant. In a second analysis, Bonferroni correction was applied to 34 unique questions, and a *P* of less than .00147 was accepted as statistically significant for all comparisons.

## Results

Nine hundred seventy-six residents (31%) completed the questionnaire: 123 first-year residents (R1, 13%), 174 second-year (R2, 18%), 204 third-year (R3, 21%), 238 fourth-year (R4, 24%), and 237 fifth-year (R5, 24%). Median age was 30, and 95% of the residents were age 27 or older. Most residents (89%) were male. Sixty-two percent were married, and 15% reported being in serious relationships. Thirty-three percent reported having at least 1 child. Eighty-seven percent were from academic-center–based programs; 81.5% trained in urban medical centers, 15.5% in suburban, and only 3% in rural. Median size of the residents' training programs was 5 to 6 residents per year. Forty-six states were represented, with 7 states, New York (11.2%), Pennsylvania (7.9%), California (7.7%), Michigan (7.3%), Texas (7.1%), Illinois (7.0%), and Minnesota (5.2%), representing 53.4% of all resident responders.

Eighty-five program directors (56%) returned the completed survey. Median time as residency program director was 5 years. Median time in practice ranged from 16 to 20 years. There were only 3 women (3.5%) among the responders. Of the responders, 90.6% were from university-based programs; 84.7% were trained in urban medical centers, 8.2% in suburban, and 7.1% in rural. Median size of the represented programs was 3 to 4 residents per year. Thirty-seven states were represented, with 6 states, New York (10.6%), California (10.6%), Florida (5.9%), Michigan (5.9%), Ohio (5.9%), and Texas (5.9%), representing 44.8% of all director responders.

### Resident Education

Fourteen questions were asked about perceived effects of the work-hour regulations on resident education (Table I, Figure 1). Three of these questions were directed only to program directors specifically to address their perceptions of resident performance (Appendix I; questions 11-13). All responses except 3 were significantly different from the hypothetical mean of 3 corresponding to *no opinion* on the Likert scale. There were significant differences among junior residents, senior residents, and directors on all questions before the Bonferroni correction. After correction, there was no statistically significant difference between opinions about the statement on increased resident operative time; statistical differences between means for all the other questions persisted.

Overall, junior residents were more likely to agree with perceptions of improved education resulting from work-hour regulations. Junior residents tended to agree that, because of the rules, residents spend more time reading and have improved basic science knowledge. They also tended to agree that the work rules have improved training and are beneficial for resident education. However, junior residents disagreed with the statements that the new rules increased residents' operative time and improved their operative experience.

Senior residents were significantly less positive about the effects of the rules on resident education. Compared with junior residents, they were significantly more likely to disagree with most of the 11 statements in the education portion of the survey. They disagreed with statements describing the new rules as being beneficial to training, as having improved residents' basic science knowledge, and as having improved resident education. Senior residents, just like their junior colleagues, felt that the new rules did not increase residents' operative time or improve their operative experience.

Compared with junior and senior residents, program directors were significantly more critical of the effects of the work rules on education. They disagreed with all 14 statements posed to them. Regarding these statements, almost all the differences between junior residents and program directors were statistically significant. Program directors' opinions were similar to senior residents' opinions about lack of

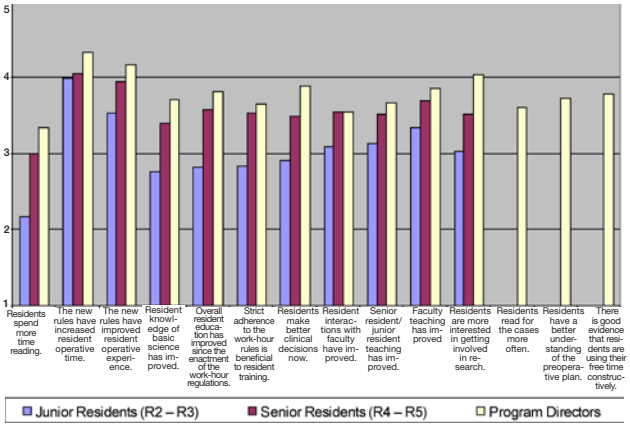


**Figure 1. Results for the education portion of the questionnaire. Strongly agree (1), moderately agree (2), no opinion (3), moderately disagree (4), strongly disagree (5).**

**Table I. Results for Education Portion of Questionnaire***

| Question | Junior Residents (R2-R3) | Senior Residents (R4-R5) | Program Directors | ANOVA *P*< | Dunn Posttest[a] $P_1$< | $P_2$< | $P_3$< |
|---|---|---|---|---|---|---|---|
| Residents spend more time reading | 2.17 (±1.02) | 3.00 (±1.23)[b] | 3.34 (±1.06) | .0001 | .001 | .001 | 05[c] |
| The new rules have increased resident operative time | 4.00 (±0.96) | 4.05 (±0.97) | 4.34 (±0.72) | .0184[c] | NS | .05[c] | NS |
| The new rules have improved resident operative experience | 3.54 (±1.25) | 3.95 (±1.01) | 4.18 (±0.83) | .0001 | .001 | .001 | NS |
| Resident knowledge of basic science has improved | 2.76 (±1.05) | 3.40 (±1.04) | 3.72 (±0.88) | .0001 | .001 | .001 | .05[c] |
| Overall resident education has improved since the enactment of the work-hour regulations | 2.83 (±1.21) | 3.58 (±1.13) | 3.82 (±1.04) | .0001 | .001 | .001 | NS |
| Strict adherence to the work -hour rules is beneficial to resident training | 2.84 (±1.33) | 3.54 (±1.27) | 3.65 (±1.15) | .0001 | .001 | .001 | NS |
| Residents make better clinical decisions now | 2.91 (±1.15)[b] | 3.49 (±1.08) | 3.89 (±0.93) | .0001 | .001 | .001 | .01 |
| Resident interactions with faculty have improved | 3.10 (±0.96) | 3.55 (±0.97) | 3.56 (±0.87) | .0001 | .001 | .001 | NS |
| Senior resident/junior resident teaching has improved | 3.14 (±0.99) | 3.52 (±1.09) | 3.67 (±0.93) | .0001 | .001 | .001 | NS |
| Faculty teaching has improved | 3.34 (±0.89) | 3.70 (±0.92) | 3.87 (±0.84) | .0001 | .001 | .001 | NS |
| Residents are more interested in getting involved in research | 3.04 (±1.19)[b] | 3.53 (±1.13) | 4.04 (±0.84) | .0001 | .001 | .001 | .001 |
| Residents read for the cases more often | NA | NA | 3.61 (±0.94) | NA | NA | NA | NA |
| Residents have a better understanding of the preoperative plan | NA | NA | 3.73 (±0.86) | NA | NA | NA | NA |
| There is good evidence that residents are using their free time constructively | NA | NA | 3.79 (±0.94) | NA | NA | NA | NA |

*R2, second-year resident; R3, third-year resident, R4, fourth-year resident; R5, fifth-year residents; ANOVA, analysis of variance (Kruskal-Wallis test); NA, not applicable; NS, not significant at *P*<.05.
[a]$P_1$ = *P* for post-ANOVA comparison of junior and senior residents; $P_2$ = *P* for post-ANOVA comparison of junior residents and program directors; $P_3$ = *P* for post-ANOVA comparison of senior residents and program directors.
[b]Not significantly different from mean of *no opinion* (3).
[c]Nonsignificant after Bonferroni correction at *P*<.00147.

improvement in operative experience, lack of overall improvement in resident education, and lack of benefit to resident training. Directors also did not agree that the rules led to residents reading for the cases more often, having a better understanding of the preoperative plan, or using their free time constructively. Program directors did not agree that residents were more interested in research involvement since implementation of the work-hour regulations.

### Quality of Life

The section on resident QOL had 8 questions (Table II, Figure 2), 2 of which were posed only to residents (Appendix II; questions 18, 19). All the answers were significantly different from the hypothetical mean of *no opinion*. There were statistically significant differences among junior residents, senior residents, and directors on all questions, and these differences persisted after Bonferroni correction.

There was overall agreement that resident QOL had improved as a result of the work-hour regulations. Junior residents tended to agree that they felt more rested, had an improved QOL, spent more time with their family and socializing, and had improved interactions with other residents as a result of the regulations. Senior residents, on the other hand, were more neutral but not in disagreement about being more rested, spending more time with family, socializing, and having improved interactions with other residents. Differences between junior and senior residents were statistically significant. Both junior and senior residents tended to disagree with the statement that their amount of home call had decreased, with the senior residents being significantly more likely to feel this way. Both junior and senior residents agreed that spending their free time with their families and being outside the hospital were important to them.

Overall, program directors agreed that the new rules had improved resident QOL. They did not believe that home call had decreased, but they agreed that, since implementation of the work rules, residents were more rested, had an improved QOL, and spent more time with friends and family. They did not believe that there was any improvement in residents' interactions with other residents—a significant difference from the opinion of the junior (but not senior) residents.

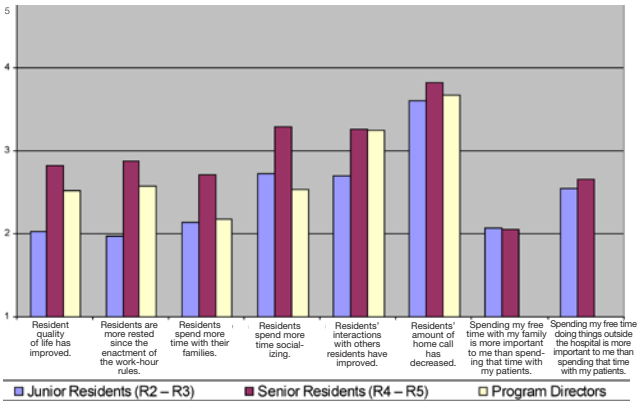


**Figure 2.** Results for the quality-of-life portion of the questionnaire. Strongly agree (1), moderately agree (2), no opinion (3), moderately disagree (4), strongly disagree (5).

**Table II. Results for Quality-of-Life Portion of Questionnaire***

| Question | Junior Residents (R2-R3) | Senior Residents (R4-R5) | Program Directors | ANOVA *P*< | Dunn Posttest[a] | | |
|---|---|---|---|---|---|---|---|
| | | | | | $P_1$< | $P_2$< | $P_3$< |
| Resident quality of life has improved | 2.04 (±0.94) | 2.83 (±1.17) | 2.53 (±0.98) | .0001 | .001 | .001 | NS |
| Residents are more rested since the enactment of the work-hour rules | 1.98 (±1.00) | 2.88 (±1.21) | 2.58 (±1.14) | .0001 | .001 | .001 | NS |
| Residents spend more time with families | 2.15 (±0.94) | 2.72 (±1.11) | 2.18 (±0.69) | .0001 | .001 | NS | .001 |
| Residents spend more time socializing | 2.73 (±1.02) | 3.30 (±1.02) | 2.54 (±0.73) | .0001 | .001 | NS | .001 |
| Resident interactions with other residents have improved | 2.71 (±0.96) | 3.27 (±1.02) | 3.25 (±0.87) | .0001 | .001 | .001 | NS |
| Resident amount of home call has decreased | 3.61 (±0.93) | 3.83 (±1.02) | 3.68 (±1.05) | .0004 | .001 | NS | NS |
| Spending my free time with my family is more important to me than spending that time with my patients | 2.08 (±0.98) | 2.06 (±0.98) | NA | NA | NS | — | — |
| Spending my free time doing things outside the hospital is more important to me than spending that time with my patients | 2.56 (±1.08) | 2.67 (±1.15) | NA | NA | NS | — | — |

*R2, second-year resident; R3, third-year resident, R4, fourth-year resident; R5, fifth-year residents; ANOVA, analysis of variance (Kruskal-Wallis test); NA, not applicable; NS, not significant at *P*<.05.
[a]$P_1$ = *P* for post-ANOVA comparison of junior and senior residents; $P_2$ = *P* for post-ANOVA comparison of junior residents and program directors; $P_3$ = *P* for post-ANOVA comparison of senior residents and program directors.

### Patient Care

Patient care was addressed with 12 questions (Table III, Figure 3), 2 of which were asked only of the program directors (Appendix I; questions 31, 32). ANOVA identified statistically significant differences among the 3 responder groups on all 12 questions, and these differences persisted after Bonferroni correction. Most of the mean responses were significantly different from *no opinion,* except for junior residents' opinions about continuity of care, number of errors, and quality of care and for senior residents' and program directors' opinions about worsening of patient care.

Junior residents felt that the regulations were good for surgical training and patient care. Senior residents and program directors disagreed with the statement, and the differences were statistically significant. Senior residents and directors felt that continuity of care was negatively affected, that patient care had been negatively affected because of residents' leaving postcall, and that the resident work ethic had worsened. Junior residents, on the other hand, disagreed with all 3 of these statements, and the differences were all statistically significant. The overall consensus was that quality of patient care has not worsened. None of the 3 responder groups thought that number of patient-care errors had decreased. Junior residents, senior residents, and program directors did not think that there was any improvement in quality of patient care or in faculty and senior resident supervision as a result of the new regulations. Nonetheless, compared with junior residents, senior residents and program directors were significantly more negative in response to most of these statements.

Last, program directors disagreed with the statement that residents know their patients better since implementation of work-hour limits. Directors were neutral about need for a longer residency, with a nonsignificant trend toward disagreement with the statement.

### Program Adjustments

Both directors and residents were surveyed about program adjustments made to accommodate the new requirements. Eighty-one (95%) of the program directors reported implementing at least 1 change; 29% of these 81 directors implemented night-float, 31% implemented at-home call, 9% decreased number of rotations, 13% decreased number of affiliations, and 4% decreased size of teaching service. 44 (53%) of the programs hired additional personnel; 82% of these 44 programs hired physician assistants, 42% hired nurse practitioners, 11% hired registered nurses, and 1 hired additional house officers.

Residents reported similar numbers. Ninety-three percent reported at least 1 change to the program: 35%, introduction of night-float; 29%, change to at-home call; 7%, decreased number of rotations; 10%, decreased number of affiliations; 2%, reduction in size of teaching service. Thirty-seven percent of the residents indicated that their program hired additional personnel.

## Discussion

The purpose of this survey was to evaluate the initial attitudes of orthopedic surgery residents and program directors toward the ACGME work-hour regulations. This was a nationwide survey conducted approximately 6 months after mandatory implementation of the rules. Some programs captured by our survey, particularly those in New York state, had implemented these regulations earlier, as a result of state guidelines; others became compliant

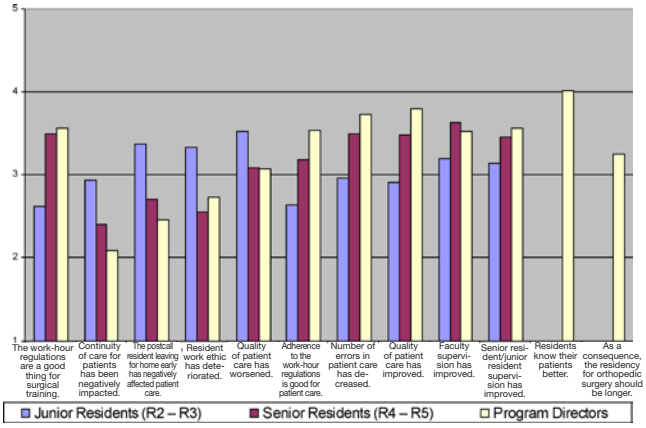


**Figure 3.** Results for the patient care portion of the questionnaire. Strongly agree (1), moderately agree (2), no opinion (3), moderately disagree (4), strongly disagree (5).

**Table III. Results for Patient-Care Portion of Questionnaire**

| Question | Junior Residents (R2-R3) | Senior Residents (R4-R5) | Program Directors | ANOVA *P*< | Dunn Posttest[a] *P*$_1$< | *P*$_2$< | *P*$_3$< |
|---|---|---|---|---|---|---|---|
| The work-hour regulations are a good thing for surgical training | 2.62 (±1.29) | 3.5 (±1.32) | 3.56 (±1.27) | .0001 | .001 | .001 | NS |
| Continuity of care for patients has been negatively impacted | 2.94 (±1.25)[b] | 2.41 (±1.18) | 2.09 (±1.11) | .0001 | .001 | .001 | NS |
| The postcall resident leaving for home early has negatively affected patient care | 3.38 (±1.25) | 2.7 (±1.23) | 2.46 (±1.14) | .0001 | .001 | .001 | NS |
| Resident work ethic has deteriorated | 3.33 (±1.26) | 2.55 (±1.32) | 2.73 (±1.24) | .0001 | .001 | .001 | NS |
| Quality of patient care has worsened | 3.53 (±1.15) | 3.09 (±1.17)[b] | 3.07 (±1.13)[b] | .0001 | .001 | .01 | NS |
| Adherence to the work-hour regulations is good for patient care | 2.64 (±1.23) | 3.19 (±1.19) | 3.54 (±1.10) | .0001 | .001 | .001 | .05[c] |
| Number of errors in patient care has decreased | 2.97 (±0.97)[b] | 3.5 (±0.97) | 3.73 (±0.88) | .0001 | .001 | .001 | NS |
| Quality of patient care has improved | 2.91 (±1.06) | 3.48 (±1.04) | 3.80 (±0.92) | .0001 | .001 | .001 | .05[c] |
| Faculty supervision has improved | 3.2 (±0.88) | 3.64 (±0.87) | 3.53 (±0.92) | .0001 | .001 | .01 | NS |
| Senior resident/junior resident supervision has improved | 3.15 (±0.87) | 3.46 (±0.97) | 3.56 (±0.94) | .0001 | .001 | .001 | NS |
| Residents know their patients better | NA | NA | 4.02 (±0.84) | NA | NA | NA | NA |
| As a consequence, the residency for orthopedic surgery should be longer | NA | NA | 3.25 (±1.23) | NA | NA | NA | NA |

*R2, second-year resident; R3, third-year resident, R4, fourth-year resident; R5, fifth-year residents; ANOVA, analysis of variance (Kruskal-Wallis test); NA, not applicable; NS, not significant at *P*<.05

[a]$P_1$ = *P* for post-ANOVA comparison of junior and senior residents; $P_2$ = *P* for post-ANOVA comparison of junior residents and program directors; $P_3$ = *P* for post-ANOVA comparison of senior residents and program directors.

[b]Not significantly different from mean of no opinion (3).

[c]Nonsignificant after Bonferroni correction at *P*<.00147.

when the rules were implemented by ACGME. Thus, we captured a wide variety of opinions among both residents and program directors. We felt the 6-month time-point to be particularly valuable because it captured the state of affairs before the changes had become ingrained in the fabric of residency training. We assessed the attitudes of residents who had experienced residency both before and after the rules came into effect, and thus we were able to see directly how residency training was affected by the rules.

We excluded postgraduate year 1 residents from our study for 2 reasons. The majority of interns' time is spent outside the orthopedic surgery departments, and thus their experience is not relevant to the particular topic of our study. In addition, interns had no experience under the old system and would not have been able to compare preimplementation and postimplementation experiences directly.

We focused on 3 residency aspects that could potentially be affected by the regulations: education, QOL, and patient care. Many authors have expressed concern that limiting resident hours would have a negative impact on quality of education,[14-18] primarily because of the potential decrease in number of operative cases by residents, limited follow-up for patients admitted during the on-call period, and unrealistic preparation for the practice of their specialty, which largely does not limit working hours for physicians who have completed their training. On the other hand, several studies have examined resident performance on in-training examinations and found some evidence to suggest that residents performed better when they worked fewer hours or were more rested.[4,13] The survey results suggest that both orthopedic residents and residency program directors are concerned about the potential negative impact of the ACGME rules on quality of education. Although junior residents viewed the educational impact of the regulations more positively than did senior residents and program directors, particularly with respect to increased reading time and basic science knowledge, program directors and residents at all levels felt there was no improvement in the operative experience as a result of the regulations. Neither residents nor program directors felt that operative time had increased. Increased operative time is a serious concern because a significant portion of orthopedic surgery training involves the operating room experience. The ACGME Orthopaedic Residency Review Committee requires that residents maintain a log of all operative cases performed during training, and site visits emphasize availability of and involvement in a sufficient "volume and variety" of cases, though no volume targets have been specified. There is evidence that, with proper management and leadership, surgical experience can be maintained in the context of fewer working hours.[19] Surgical experience may be shifted to different years of residency,[13] and the variety of experience can be maximized by minimizing redundancy and inefficiency. In the past year, several investigators have reported studies that examined the effect of reduced work hours on surgery performed by general surgery residents by comparing prospectively collected data before and after implementation of work-hour limits.[20-23] No significant impact on operative experience was found in any of these studies, but Spencer and colleagues,[23] focusing on a pediatric surgery service, found that, though residents maintained involvement in surgical cases, they significantly decreased their attendance at outpatient clinics.

It has been shown that a large proportion of residents' time is spent doing work that does not contribute to their education.[24-26] Minimizing such "service," making better use of information technologies, and shifting some routine responsibility onto ancillary personnel may well be the key to maximizing the educational efficiency of limited work hours.[14] For example, Knickman and colleagues,[27] analyzing tasks performed by internal medicine residents, suggested that at least 19% of these activities could be performed by nonphysicians, such as nurses and laboratory technicians, and that, if midlevel practitioners such as physician assistants were involved, up to 45.6% of resident activities could be performed by nonphysicians without detracting from residents' education.

Resident QOL was one of the driving issues for the reform.[24,28,29] Not surprisingly, our results suggest a perceived improvement in this area after implementation of the new rules—which agrees with results from other resident surveys.[12,13,19] Interestingly, senior residents were more likely to disagree that there was an increase in socializing, improvements in interactions with other residents, and decreased use of home call. This finding may reflect the shifting of the burden of work

to more senior levels. Thus, many senior residents, having worked longer hours during their junior years, may experience increased dissatisfaction as they are required to work longer hours yet again. This outcome may be a product of the recent implementation of the work rules in the majority of the residency programs, which tended to benefit junior residents; senior residents were most likely junior residents before implementation. Nonetheless, if this effect does exist, it may be minimal because senior residents still agreed that overall resident QOL had improved since implementation of the rules. Improved QOL is important because it may lead to more work satisfaction and perhaps better care. Long hours may contribute to negative attitudes,[30] which may adversely affect residents' interactions with other residents, faculty, and patients. In a survey, up to 25% of general surgery residents were shown to have regretted choosing their profession,[31] which could be attributed to long hours and QOL issues. Although long hours may be a "rite of passage" and may even have educational value in terms of teaching endurance and dedication, there may be even greater benefits gained from improvements in resident QOL.

The goal of improved patient care was the driving force behind the Bell Commission in New York state and a primary justification for implementation of work-hour limits. Until recently, there had been no evidence showing that the work rules actually resulted in improved patient care. In an analysis of mortality in New York teaching and nonteaching hospitals before and after implementation of the 405 regulations, Howard and colleagues[32] demonstrated an overall decrease in mortality but no difference between teaching and nonteaching institutions. They hypothesized that improvements resulting from less fatigue in residents may have been offset by the negative effects of reduced continuity of care. A chart review of a New York hospital 1 year after implementation of the rules documented increased numbers of complications, particularly electrolyte abnormalities on a general medical service. There were also increases in number of patients with at least 1 complication and in delays in obtaining diagnostic studies.[7] These increases may be associated with decreased continuity of care resulting from residents' leaving the hospital to keep their hours within established limits and from transferring patients to covering physicians. Petersen and colleagues[8] showed an increase in reports of adverse events, including preventable events, associated with cross-coverage on a medical service.

According to new evidence, reduced work hours may actually reduce medical errors in an intensive care environment. A prospective randomized study of medical interns working in the medical intensive care and coronary care units showed that shorter shifts with more rest in between were associated with significantly reduced rates of serious medical errors, including medication and diagnostic errors.[33] In this study, a decrease in time worked, from 77 to 81 hours per week to 60 to 63 hours per week, was enhanced by a modified schedule switching from traditional 24-hour shifts to approximately 15-hour shifts, which allowed for more sleep, particularly in the 24 hours preceding each working shift.[34] There was no difference in procedural errors in this study, even though there were more procedures performed during the modified schedule.[33]

Several recent studies have examined the effects of the 80-hour work week on surgical outcomes.[21,35,36] Malangoni and colleagues[21] found a decrease in mortality after work hours on the trauma service were reduced, but they did not comment on the statistical significance of the change. Schenarts and colleagues[35] examined the effect of a night-float rotation on complications and clinical outcomes on a general surgery trauma service and found no differences in complications, length of hospital stay, ventilator days, or mortality. Similarly, no significant effects of reduced hours on postoperative complications were found in a general surgery service study conducted by Kaafarani and colleagues.[36]

The results of our survey reflect senior residents' and program directors' concerns about the effects of shorter hours on patient care. Junior residents reported significantly more positive attitudes toward improvements in patient care than did senior residents or program directors. Although there was a consensus that quality of care had not improved, junior residents felt that the rules were good for surgical training, good for patient care, and did not lead to decreased work ethic or poor patient care. As expected, senior residents and program directors were significantly more critical of the work-hour rules from the standpoint of patient care. Nonetheless, no group felt that patient care had worsened as a result of the regulations.

It is now clear that successful implementation of the rules requires scheduling changes and other modifications. It is interesting that 37% of the residents surveyed, versus 53% of the program directors surveyed, indicated that their program hired additional personnel. A similar discrepancy was reported earlier.[11] We suspect that this discrepancy resulted from residents simply being unaware of the hiring that occurs and perhaps from the limited impact of these additional staff on resident-covered services. Hiring additional health care providers (physician assistants, nurse practitioners, registered nurses, orthopedic house officers) is needed to compensate for loss of resident work hours, but hiring additional personnel comes with significant cost. This is true for each institution and becomes even more significant when considered nationally. In New York, the cost of hiring a physician assistant or nurse practitioner is approximately $90,000 per year, including salary and fringe benefits. Although this figure varies geographically, the additional cost to the institutions will be significant, particularly in the context of the current health care reimbursement environment. It has become increasingly difficult for hospitals to manage financially in the current climate, and these additional expenses only increase that difficulty. In one study, the cost of hiring additional patient-care personnel was estimated to be $673 million to $1.1 billion nationwide.[37] Analysis suggested that a 5.1% to 8.5% decrease in adverse events may compensate for the increased cost to society, but up to a 18.5% to 30.9% decrease in adverse events would be needed for the teaching hospitals to recoup their costs.

Relatively few program directors and residents reported decreasing the number of rotations, the number of affiliations, or the size of the teaching service to accommodate the rules. These changes appeared to be associated with some improvements in teaching, basic science knowledge, and QOL, but they appeared to worsen perceptions of quality of patient care.

Our survey is limited by our achieving only a 31% response, even though this represented more than 900 residents. This low response rate likely resulted from a combination of factors, including an "overload" of similar surveys, length of this survey, and orthopedic residents' limited free time, despite the work-hour regulations.

This was an attitudinal survey, and we did not investigate the actual effects of the new rules on education, resident QOL, and quality of patient care. This survey was conducted within the first year of the "official" implementation of the work rules, and it is possible that many

programs had not fully adjusted to the new rules. In addition, the junior residents were more likely to be positively affected by the work rules, whereas the senior residents were more likely to be negatively affected. From our own experience, it is evident that the reduced work hours of the junior residents are often assumed by the senior residents. This is most likely an important factor in the differences of opinions evident when the junior residents were compared with the senior residents in the areas of resident education, QOL, and patient care. The program directors had their own experience as residents to consider, as well as their experience as program directors before implementation of the work rules. We believe it will be important and instructive to redo the survey in 5 years. By that time, all residents will have been treated "equally" under the new work rules. In addition, the program directors will have had more experience with the new system, and changes in their attitudes may become more apparent. We anticipate that differences in attitudes between junior and senior residents will be much less evident, though differences in attitudes of the program directors may persist.

Regardless of how we feel about these work-hour rules, they are here to stay. What is needed is an objective evaluation of the residency education system. Physician QOL and patient care may go hand in hand. Efficiency of resident training can be improved in many ways without compromising patient care—for example, through use of information technologies, innovative scheduling, and ancillary support staff. Future studies, which should investigate the utility of such interventions, may lead to a lean, efficient system that trains more rested physicians who provide excellent patient care.

## Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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## Appendix I. Core of the Survey Posed to the Program Directors

*Answer choices for each question: strongly agree (1), moderately agree (2), no opinion (3), moderately disagree (4), strongly disagree (5).*

**Question**

1. Residents spend more time reading.
2. The new rules have increased resident operative time.
3. The new rules have improved resident operative experience.
4. Resident knowledge of basic science has improved.
5. Overall resident education has improved since the enactment of the work-hour regulations.
6. Strict adherence to the work-hour rules is beneficial to resident training.
7. Residents make better clinical decisions now.
8. Resident interactions with faculty have improved.
9. Senior resident/junior resident teaching has improved.
10. Faculty teaching has improved.
11. Residents read for the cases more often.
12. Residents have a better understanding of the preoperative plan.
13. There is good evidence that residents are using their free time constructively.

14. Residents are more interested in getting involved in research.
15. Overall resident quality of life has improved.
16. Residents are more rested since the enactment of the work-hour rules.
17. Residents spend more time with their families.
18. Residents spend more time socializing.
19. Resident interactions with other residents have improved.
20. Resident amount of home call has decreased.
21. The work-hour regulations are a good thing for surgical training.
22. Continuity of care for patients has been negatively impacted.
23. The postcall resident leaving for home early has negatively affected patient care.
24. Resident work ethic has deteriorated.
25. Quality of patient care has worsened.
26. Adherence to the work-hour regulations is good for patient care.
27. Number of errors in patient care has decreased.
28. Quality of patient care has improved.
29. Faculty supervision has improved.
30. Senior resident/junior resident supervision has improved.
31. Residents know their patients better.
32. As a consequence, the residency for orthopedic surgery should be longer.

## Appendix II. Core of the Survey Posed to Residents

*Answer choices for each question: strongly agree (1), moderately agree (2), no opinion (3), moderately disagree (4), strongly disagree (5).*

**Question**

1. I spend more time reading.
2. The new rules have increased my operative time.
3. The new rules have improved my operative experience.
4. My knowledge of basic science has improved.
5. Overall my education has improved since the enactment of the work-hour regulations.
6. Strict adherence to the work-hour rules is beneficial to my training.
7. I make better clinical decisions now.
8. My interactions with faculty have improved.
9. Senior resident/junior resident teaching has improved.
10. Faculty teaching has improved.
11. I am more interested in getting involved in research.
12. My quality of life has improved.
13. I am more rested since the enactment of the work-hour rules.
14. I spend more time with my family.
15. I spend more time socializing.
16. My interactions with other residents have improved.
17. My amount of home call has decreased.
18. Spending my free time with my family is more important to me than spending that time with my patients.
19. Spending my free time doing things outside the hospital is more important to me than spending that time with my patients.
20. The work-hour regulations are a good thing for my surgical training.
21. Continuity of care for patients has been negatively impacted.
22. The postcall resident leaving for home early has negatively affected patient care.
23. Resident work ethic has deteriorated.
24. Quality of patient care has worsened.
25. Adherence to the work-hour regulations is good for patient care.
26. Number of errors in patient care has decreased.
27. Quality of patient care has improved.
28. Faculty supervision has improved.
29. Senior resident/junior resident supervision has improved.

## Commentary

This is the second survey on the resident work hours that has been conducted by Dr. Zuckerman and colleagues. The first survey results were published in *The Journal of Bone & Joint Surgery* in 2005.[1] It looked at the strict enforcement of Section 405 in the New York State Public Health Code to restrict resident work hours to 80 hours per week.

The current survey was sent to all residents and program directors after the institution of the 80-hour work week by the ACGME. There are a few minor differences in the two survey results. In the first survey, junior residents did feel that their surgical experience had been reduced by the new work hours. In this survey, junior and senior residents did not feel the work hour restrictions affected their surgical experience either positively or negatively.

The main reason for the development for the work-hour rule was improvement in patient care. The junior residents felt that the change was good for patient care, but the senior residents and program directors were not sure. However, none of the three groups felt that patient care was adversely affected. Because this was an attitudinal survey, there wasn't any hard data to back up their perception on the quality of patient care.

This survey brought out the various ways that the different programs dealt with the enforced work-hour limitation. This includes the institution of night float and hiring more advanced practice nurses, physician assistants, or other personnel. In the discussion section, they point out the cost to the health care system of hiring these individuals. This does change the bottom line, as it makes it difficult for hospitals to remain profitable in this time of decreasing reimbursement.

What does this mean for the future? It is obvious that the 80-hour work week is not going to be changed. I agree with Dr. Zuckerman and colleagues that our approach to education is going to need to vary from our traditional method. I feel that innovative methods for the teaching of surgical skills outside the operating room need to be developed. These include the use of simulators, computer-assisted education, and focus-skills courses in areas such as joint replacement and spinal surgery.

The residency review committee will have to monitor strictly both the operative and nonoperative experiences. The need for clinical time in the outpatient setting is essential for resident education. This exposure in the outpatient clinical setting cannot be compromised for increased operative education experience.

Although the number of respondents to the survey was small, it does present a fair picture of the attitudes of residents and program directors toward education, quality of life, and patient care under the new work-hour rules. The challenge to the educator is to adapt and develop new educational tools that keep our training programs efficient and effective. We owe society the development of such methodology.

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*This paper will be judged for the Resident Writer's Award.*