Medical Student Patient Experiences Before and After Duty Hour Regulation and Hospitalist Support

Lee A. Lindquist, MD MPH MBA^{1,3}, Marianne Tschoe, MD², David Neely, MD³, Joseph Feinglass, MPH PhD³, Gary J. Martin, MD³, and David W. Baker, MD MPH³

¹Division of Geriatrics, Northwestern University Feinberg School of Medicine, Chicago, IL, USA; ²Division of Hospital Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL, USA; ³Division of General Internal Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL, USA.

BACKGROUND/OBJECTIVE: With the growth of hospitalist services and the reduction in residency work hours, medical education has changed dramatically. The objective of this study was to examine changes in junior medical student-patient encounters after initiation of residency work hours and implementation of a large hospitalist practice at our academic medical center.

DESIGN: Medicine clerkship students from 2002–2007 recorded the number of hospital patients and their principal diagnoses cared for during a 6-week block rotation. Comparisons were made between clerkship experiences among students in 2002–2004 and 2005–2007 for number of patients and diversity of patient diagnoses seen. Data from the 2004–2005 transition period, when teams fluctuated during implementation of the hospitalist service, were excluded.

MEASUREMENTS AND MAIN RESULTS: A total of 4,697 patients were seen by students during the two periods, and patient logs for 154 students (3,253 patients in 2002–2004) and 120 students (1,444 patients in 2005–2007) were compared. The mean number of patients directly cared for by students on their junior medicine clerkship dropped from 21 patients (2002–2004) to 12 patients (2005–2007) per student ($p < 0.001$). Compared to 2002–2004, fewer students from 2005–2007 helped manage patients with chest pain (85.7% vs. 74.2%, $p = 0.016$), pancreatitis (66.9% vs. 23.3%, $p < 0.001$), pneumonia (69.5% vs. 54.2%, $p = 0.009$), gastroenteritis (45.5% vs. 20.8%, $p < 0.001$), or cellulitis (46.8% vs. 19.2%, $p < 0.001$). Alternatively, students from 2005–2007 saw more patients with abdominal pain (64.9% vs. 79.2%, $p = 0.010$), anemia (44.8% vs. 70.8%, $p < 0.001$), mental status changes (32.5% vs. 51.7%, $p = 0.001$), failure to thrive (16.2% vs. 53.3%, $p < 0.001$), and endocrine disorders (including diabetes, thyroid disorders, Addison's, 51.3% vs. 74.2%, $p < 0.001$).

CONCLUSIONS: With institutional and residency changes, junior medicine clerkship students had fewer opportunities for direct care of patients and encountered a different mix of patient diagnoses. Increasingly during their junior medicine clerkship, students may

not have exposure to basic medical conditions, which may affect their ability to care for future patients.

KEY WORDS: duty hour reform; medical education; hospitalist services; junior medical student.

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BACKGROUND

Over the past 5 years, the growth of hospital medicine and reduction in residency duty work hours has dramatically changed the hospital landscape. While internists, medicine residents, and patients have been affected by these changes, little is known about the effects on patient-student encounters among junior medicine students.

Much of the learning that occurs during the junior medicine clerkships is experiential, so knowing what types of clinical experiences students have during clerkships is crucial to understanding their learning. Furthermore, examining how changes in delivery systems influence the 'clinical curriculum' is essential to ensure that these experiences remain aligned with the goals and objectives of the clinical rotations.

In July 2003, resident duty hour regulations were mandated by the Accreditation Council for Graduate Medical Education (ACGME).¹ The Liaison Committee on Medical Education (LCME) subsequently recommended in February of 2004 [ED-38] that medical students should not be required to work longer hours than residents, calling for an 80-h work week, a 24-h limit on shifts, and call no more than once every 3 nights.²

Compared to before and after duty hour reform, Kogan et al. found no differences in time spent on patient care and perceptions of educational value among 69 junior medicine clerkship students.³ Surveys of clerkship directors have shown most did not believe duty hours reform had a positive impact on clerkship students' educational experiences. Time for teaching students, concerns about a shift-work mentality, and student continuity with their teams were major challenges.⁴ To our knowledge, no prior studies have explored what patient illnesses were encountered by medical students during their junior medicine clerkship for the two time periods. In order to assess what effect implementation of a hospitalist service and reduced duty hours had on our medicine clerkship, we examined the number of patients seen and the mix of principle diagnoses self-reported by junior medical students

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during the time prior to and after changes to the medicine service at our teaching hospital.

METHODS

The Junior Medicine Clerkship

Students complete 2 years of didactic teaching interwoven with experiential and interactive learning formats prior to starting the 3rd year of clerkships. During their 3rd year, all medical students completed a 12-week internal medicine junior clerkship, which consists of two 6-week blocks on the inpatient wards at two hospitals. Hospital choices included an academic university hospital, a community-based academic hospital, and a veterans administration hospital. Only the academic university hospital is included in this study because this is the only site at which students are asked to log patients.

Changes in the Hospital Medicine Service

Prior to 2004, medical teams consisted of an attending, a resident, one to two interns, one sub-intern (4th year medical student), and two junior medical students (3rd year medical students). Teams would be on call every 4th night and admit all patients up to a cutoff or cap of around 20 patients per team. Residents and attendings primarily determine which patients the medical students will participate in caring for. Because the 2004–2005 academic year was a fast-changing year with the establishment of a dedicated hospitalist service and the mandated lowering of work hours, there was great variability of student teams during this time. Hospital medicine grew dramatically from 3 hospitalists in 2003, to 9 in 2004, to 18 in 2005. We have therefore excluded the transitional academic year, 2004–2005, from the analysis.

After 2005, with residency duty hour changes, hospitalists have taken over the care of patients not covered by residents. There are now over 42 hospitalists and a newly established Division of Hospital Medicine. During 2005–2007, patients were admitted through the emergency room and triaged to either hospitalist or resident-covered services. Triage occurred in that the resident-covered services were filled first with patients. When resident-covered services were fully occupied, hospitalists then received the remaining patients. During this time period, students did not regularly rotate on the hospitalist services.

Data Collection and Analysis

At the academic university hospital, upon completion of the 6-week rotation, students submit a patient log that includes the patient and self-reported final team diagnoses (primary and all secondary) information to the clerkship director, who is responsible for the student grades. Students self-report this information, which is discussed with the clerkship director prior to grades being assigned. Student-patient logs were then collected from the clerkship director by the principal investigator. IRB exemption was obtained. All comparisons of the proportion of each diagnosis seen by the medical students were done using chi-square tests. Comparison of the mean number of patients seen in each time period was done using a t-test. Data analysis was performed using SPSS, version 16.0, (Chicago, IL).

RESULTS

A total of 4,697 patients were cared for by students during the two periods, and patient logs for 154 students (3,253 patients in 2002–2004) and 120 students (1,444 patients in 2005–2007) were compared. The response rate for junior medical students who completed forms between 2002–2004 was 85.5% (154/180), as compared to 63.3% (120/189) in 2005–2007. The mean number of patients directly cared for by students on their 6-week junior medicine clerkship dropped from 21 patients per student in 2002–2004 (range, 11–42 patients; SD 5.1) to 12 patients per student in 2005–2007 (range, 5–34 patients; SD 5.2; $p < 0.001$).

Compared to 2002–2004, fewer students from 2005–2007 saw patients with chest pain (85.7% vs. 74.2%, $p = 0.016$), pancreatitis (66.9% vs. 23.3%, $p < 0.001$), pneumonia (69.5% vs. 54.2%, $p = 0.009$), gastroenteritis (45.5% vs. 20.8%, $p < 0.001$), or cellulitis (46.8% vs. 19.2%, $p < 0.001$). Alternatively, students from 2005–2007 saw more patients with abdominal pain (64.9% vs. 79.2%, $p = 0.010$), anemia (44.8% vs. 70.8%, $p < 0.001$), mental status changes (32.5% vs. 51.7%, $p = 0.001$), failure to thrive (16.2% vs. 53.3%, $p < 0.001$), and endocrine disorders (including diabetes, thyroid disorders, Addison's, 51.3% vs. 74.2%, $p < 0.001$); see Table 1.

No significant changes were seen in numbers of students caring for patients with pyelonephritis, pulmonary emboli, gastrointestinal bleeding, syncope, chronic obstructive pulmonary disease, or congestive heart failure. There were fewer student encounters with patients with liver disorders, cancers, and HIV. These differences could be attributed to the creation of separate Liver and Oncology Services, as well as improve-

Table 1. Patient Diagnoses Encountered by Junior Medical Students

	2002–2004 (N=154 students)	2005–2007 (N=120 students)	P - value
Patient diagnoses encountered more			
Abdominal pain	64.9% (100)	79.2% (95)	0.010
Anemia	44.8% (69)	70.8% (85)	0.000
Mental status changes	32.5% (50)	51.7% (62)	0.001
Failure to thrive	16.2% (25)	53.3% (64)	0.000
Endocrine	51.3% (79)	74.2% (89)	0.000
Patient diagnoses encountered less			
Chest pain	85.7% (132)	74.2% (89)	0.016
Pancreatitis	66.9% (103)	23.3% (28)	0.000
Pneumonia	69.5% (107)	54.2% (65)	0.009
Gastroenteritis	45.5% (70)	20.8% (25)	0.000
Sickle cell disease	14.3% (22)	6.7% (8)	0.045
Cellulitis	46.8% (72)	19.2% (23)	0.000
Liver/cirrhosis	71.4% (110)	35.0% (42)	0.000
HIV/AIDS	48.7% (75)	35.8% (43)	0.033
Oncologic disorders	56.5% (87)	35.8% (43)	0.001
Patient diagnoses unchanged			
Syncope	60.4% (93)	50.0% (60)	0.086
Thromboembolism	35.1% (54)	33.3% (40)	0.765
Urinary tract infection/pyelonephritis	46.8% (72)	50.8% (61)	0.503
Congestive heart failure	80.5% (124)	75.8% (91)	0.349
COPD/asthma	59.7% (92)	55.8% (67)	0.516
Gastrointestinal bleeding	57.8% (89)	48.3% (58)	0.119
Drug- and alcohol-related injury	42.2% (65)	50.8% (61)	0.155

ments in the field of HIV, which lessened the need for admission. However, all of the reported diagnoses in Table 1 were specified as learning objectives for the junior medicine rotation.

DISCUSSION

The architecture of inpatient medicine has changed dramatically over the past 5 years with the birth of hospital medicine and the reduction in residency work hours. Although some data suggest that hospitalist and specialist services may improve patient care⁵⁻⁷, changes in our institution were associated with changes in the number and types of patients encountered by junior medical students. The results show that increasingly students may not directly care for previously basic patient-care diagnoses during their junior medicine rotation.

Reduction in patient turnover as well as resident patient "caps" could also account for the overall drop in patients encountered by medical students. Complicated patients are increasingly funneled to teaching services, with short-stay patients being assigned to Emergency Department Observation Units and hospitalists. Subsequently, a medical student may follow a very complex patient transferred from the intensive care unit for weeks. While obtaining invaluable experiences with tracheostomies and other complex issues, students may miss out on patients with basic issues.

Student assignments of patients also rely heavily on resident and intern characteristics. Considering that in our setting a resident supervises one to two interns, a sub-intern or 4th year medical student, and two 3rd year medical students, he or she may assign patients differently based on student experience and capability, case severity, personal preference, or other factors.

Among medical training centers that utilize hospitalists and adhere to residency duty hours, medical educators may need to consider many possible options to optimize the diversity of their students' patient experiences. Our institution responded to these changes by revising the junior medicine clerkship rotation so that students would gain the necessary patient experiences. Students have already begun to rotate with hospitalists during their sub-internships and found it a valuable learning experience.⁸ To further increase the number of patients seen by medical students during their junior medicine clerkship, our institution has divided the 12-week period of two 6-week inpatient blocks into three 4-week blocks, with 8 weeks committed to inpatient hospital care and the remaining 4-week block now concentrated on specialty services with high-volume inpatient and outpatient care. By making these changes, students have access to more patients and specifically encounter patients with a wider variety of medical conditions.

The Liaison Committee on Medical Education (LCME) revised its standard [ED-2] in February 2007, mandating medical schools establish systems to specify the types of student-patient encounters as well as identify and remedy any gaps in required patient-care experiences. Further advancing the requirements of the LCME, medical schools may want to aim to establish **real-time** systems that are directly accessible to attending physicians and residents so as to prevent these lapses during the rotation. At Dartmouth, for example, Nierenberg et al. have created a web-based data

system for students to document their experiences during all clinical clerkships.¹¹ Similarly, our institution has an established program of monitoring student-patient encounters, and students have become more pro-active in alerting their teachers to perceived deficiencies while on the clerkship. Supervising physicians are then able to address these potential deficiencies during the rotation, thus better tailoring the rotation to the needs of the individual student.

In addition, the number of patients with a particular diagnosis of which a student actually needs to directly care for should also be considered. It is possible that different diagnoses require different numbers of exposures, but there are no data to inform such requirements.

Other solutions require further study, but may include the use of simulation. For example, if a student does not encounter patients with a particular clinical condition, the student may be able to remedy the gap by a simulated experience (such as standardized patient experiences, online or paper cases, etc.).⁹ Leong et al. have shown that computer cases are effective learning tools and can be successfully integrated into existing clerkships,¹⁰ but additional research is needed to determine longitudinally how simulation compares with actual real-world patient experiences on the junior medicine clerkship.

This study has several limitations. Since hospital medicine growth and the reduction in residency work hours occurred concurrently, differences in student experiences could be related to either factor or both. We were unable to isolate the specific effect each had. Other limitations are student centered in that: (1) Students self-reported which patients and medical conditions they directly cared for. It is possible that this self-reporting may over- or underestimate the patients encountered, although we could not assess if such misreporting would be similar for both periods examined. (2) Fewer students responded over the later 2 years (2005-2007). Since there are eight blocks (6-weeks each) where junior medicine is offered each year, the difference is roughly two students per rotation. We do not have a concrete reason for the difference, and we were unable to determine if the two groups of students differed in other factors with potential to explain the observed differences in patient care experiences.

Further limiting this study is the localization to a single academic university hospital site. The 12-week junior medicine clerkship is divided into two 6-week blocks at two of three hospitals. Students rotate at another hospital for the other half of the clerkship. Data are not available during these time periods, so we are unable to determine if similar patterns are being seen. Similarly, more information is needed regarding what exposures students may have elsewhere in the curriculum, such as during the 4th year sub-internship and primary care outpatient rotations.

In summary, we observed that the introduction of hospitalist services and duty hour reform was associated with decreased patient experiences among junior medicine students. It is possible that other academic institutions that have instituted residency work hours or hospitalist programs may also be experiencing similar changes in volume and patients encountered by junior medical students. Physician educators need to be vigilant in assessing the needs of medical students on clerkships when changes occur at their institutions. In conjunction with the Association of American Medical Colleges (AAMC), medical schools need to come together to determine ways of real-time monitoring of medical student clerkship

activities as well as optimal ways of remediating medical students in the ever-changing medical environment.

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Corresponding Author: Lee A. Lindquist, MD MPH MBA, Division of Geriatrics, Northwestern University Feinberg School of Medicine, 750 North Lake Shore Drive, 10th floor, Chicago, IL 60611, USA (e-mail: LAL425@md.northwestern.edu).

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