
Impact of Medical Student Teaching on Family Physicians' Use of Time

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Background. The purpose of this study was to determine how much and in what ways family physicians' time at work is affected by the presence of a medical student in the practice.

Methods. The study included work sampling of 22 non-academic family physicians, each observed during 1 day with and 1 day without a medical student, and 12 academic family physicians, of whom nine were observed for 8 half-days and three for 2 or 4 half-days of clinical practice. Observations were made on average every 4 minutes at preselected random times during the workday.

Results. When a student was present at the practice, the amount of time private physicians actually spent working increased by 52 minutes per day, and their patient-care productivity decreased from 3.9 to 3.3 patients per hour. There was no significant change in time spent at work for academic physicians. With a student present,

the physicians in private practice spent 27 fewer minutes per day in patient-care activities, whereas academic physicians spent 47.5 fewer minutes per day in these activities. Private and academic physicians spent 71 and 63 minutes per day, respectively, in student-centered activities. There were few differences between physician groups in how this direct teaching time was used.

Conclusions. When a student is in the practice, private family physicians shift substantial amounts of work time from patient-centered to student-centered activities. They also use their personal time for teaching activities and experience a decrease in patient-care productivity of 0.6 patients per hour.

Key words. Family physicians; medical students; private practice; physicians' practice patterns; time management; medical education, undergraduate. (*J Fam Pract* 1996; 42:243-249)

In many medical schools, predoctoral medical education is shifting from inpatient to outpatient settings and from tertiary to primary care practice.^{1,2} In the ambulatory setting, however, little is known about the effect of a medical student's presence on a physician's workload or use of time. In a survey of Missouri family physicians, preceptors in nonacademic practice reported perceiving that having a medical student in the practice lengthened their average workday by about 46 minutes,³ a finding that is similar to that of other studies.^{4,5} However, why and how the day is lengthened are questions that have not been addressed.

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Two studies have explored medical students' use of clinical and teaching time. Walter et al⁶ observed medical students in an ambulatory clinic and found that they spent 16% of their time interacting with physician-teachers. Weinberg and associates⁷ collected activity log data from third-year medical students in teaching hospitals and found that each student spent an average of 6.6 hours per day with physician-teachers, including 3.3 hours per day providing patient care under direct physician supervision. Neither study, however, examined how the physicians involved used their nonteaching time or compared physician activity with and without a student.

To examine physician use of time, Crandall and colleagues⁸ continuously monitored physician faculty at rural teaching clinics. They found that physicians spent 19.6% of their time in direct student contact without a patient present, 17.9% in patient contact without a student present, and 7.6% in patient contact with a student

present. Hekelman et al⁹ described clinical teaching behaviors, observing 16 physician faculty during 10 teaching encounters each. They found that clinical teaching was driven by patient-care concerns, with most of the teaching time devoted to such activities as providing patient-care information and asking simple fact-recall questions. In their study, physicians spent little time asking questions that required synthesis, providing feedback, or directly observing the student. In only 15.6% of teaching encounters did physicians directly observe the student providing patient care. Neither of these studies compared physician activity when a student was in the practice with physician activity without a student, and neither reported the total length of the physician's workday.

Several studies have examined the effects of medical student teaching on physician workload in primary care settings. Some have shown decreased volume of work when a student is present,^{4,5,10-12} while others^{13,14} found no effect. In the study by Fields and associates,¹⁴ the average cost of teaching a student was \$52 per day among 22 rural primary care physicians, and \$138 per day for the 12 rural family physicians in the study. Those costs were not statistically significant but could be financially significant, amounting to \$1000 and \$2700, respectively, for a 4-week preceptorship. In addition, the physicians in their study did not report how much time they spent at work.¹⁴ In other published reports, Lindenmuth and colleagues¹¹ studied only two physicians, and Garg et al¹⁰ compared the productivity of academic physicians with that of private practitioners, two physician groups that may be systematically dissimilar. Kearl and Mainous¹³ found no change in the number of patients seen when a student joined a physician's practice in an academic setting, while Kirz and Larsen⁵ found a decrease of one patient per half-day in a health maintenance organization clinic, but neither study reported time spent at work. In the study of a third-year clerkship by Pawlson et al,¹² faculty physicians reported spending 22% of their clinical time in medical student education, equivalent to 62 minutes per student per day, but the total time spent at work was not reported in this paper or a subsequent one.⁴ We have found no study that has examined both some measure of workload (eg, patients per day or dollars of business done per day) and time spent at work by the same or similar physicians with and without a student.

We therefore conducted a study to learn more about how teaching a medical student would affect the use of time by family physicians in either a private or an academic setting. We addressed three questions: (1) does the time physicians spend at work change when a medical student is in the practice? (2) does productivity change, as measured by the number of patients seen per working hour? (3) how does the physicians' use of work time change?

Methods

Medical students at the University of Missouri-Columbia spend 4 weeks working with family physicians in nonacademic practice and 4 weeks in an ambulatory primary care clerkship with academic physicians. At the time of this study, most students completed the preceptorship early in their fourth year; the clerkship was usually scheduled later. The private physicians volunteered their time and were not reimbursed in any way.

We contacted 29 family physicians who were scheduled to host a medical student in the summer of 1994; 22 of them agreed to participate in the study. Most of the participating physicians were in practice in small towns in Missouri, although three were practicing in major metropolitan areas. A majority were allopathic physicians; two were osteopathic physicians. All but five of the 22 were residency trained, and 15 were certified by the American Board of Family Practice. A research assistant directly observed each physician for two working days, one during which a medical student was present in the practice and one during which none was present. For each physician, both observation days were on the same day of the week, which was chosen by the physician as most representative of his or her usual workload (ie, with no special meetings or other atypical events scheduled). For each day of observation, we recorded the time the physician started and ended the workday and the number of billable patient encounters, including hospital, office, and nursing home patients. We calculated that observing 16 physicians for 2 days each would allow us to detect a difference in the length of the workday of one standard deviation, which we estimated to be 30 minutes.¹⁵

We observed 10 academic family physicians from a university (nine for 8 half-days and one for 4 half-days) and two academic family physicians from a community-based residency program affiliated with the university for 2 half-days each. With each physician, one half of the observation dates were with and one half were without a student; we were able to match those dates by day of the week 80% of the time. In the analysis, we defined a physician's workday as either 1 entire day or 2 half-days in practice. Of 84 occasions during which physicians were observed with a student present, 70 (83%) were conducted after the student had completed at least 2 weeks of the 4-week course.

To learn how the physicians' use of time changed when a medical student was in the practice, we conducted a time and motion study. These are generally of two types: work activity analysis and work sampling. In a medical clinic study, the two methods gave comparable results with little evidence of changes in the observed behavior when continuous observation was used.¹⁶ Both have been

used to study medical education in residency training¹⁷⁻²⁰ and medical student education in inpatient settings.⁷ Since we were observing only one worker (the physician-teacher) on any one occasion and wanted to avoid revealing the times of observation, we adopted a hybrid design in which the research assistant continuously observed the physician but recorded the physician's activities only at preselected random times.

To detect a change of one percentage point in an activity given a 5% baseline rate of that activity, we calculated^{21,22} a desired sample size of 1900 observations in each of four samples: academic and private physicians, with and without a medical student. We generated lists of specified times, randomly selecting one half of all 2-minute intervals during a workday. Using one of the lists, a research assistant continuously observed a participating physician, recording observations only for preselected times and coding the physician's activity. The method of choosing observation times was not revealed to the participating physicians, who were continuously observed, except when a patient or the physician did not want the research assistant present.

We developed a list of physician activities and refined and expanded it in pilot testing. The final list included 35 activities. Codes were grouped into patient-centered activities, eg, taking history, doing physical examination, discussing treatment; student-centered activities, generally based on the categories in Hekelman et al⁹; administrative activities; travel both from site to site and from room to room within the office; personal time; and other. For observations when the physician was engaged in more than one activity, the dominant activity determined the coding, with student-centered activities always taking precedence. When the research assistant was not in the room with the physician during the observation time, the activity was coded as "unobserved" unless the physician reported to the research assistant what activity took place, eg, performing physical examination. Interrater reliability among the research assistants was 0.72 at the start of the study and 0.82 at the end. Most discordant observations involved codes within the same group. Ambiguities in observations were resolved by consensus in weekly team meetings involving all research assistants.

At each observation time on a day when a medical student was working with the physician, we also recorded whether the student was present in the room with the physician and, if so, whether the student was actively or passively involved in the physician's activity.

The amount of time each physician spent in a given activity per day, with and without a student, was calculated by dividing the number of observations in which the activity was noted by the total number of observations of that physician, and then multiplying by the total number

of minutes in the physician's workday. In comparing academic and private physicians, we considered the length of the academic physicians' workday to be one half the total of the 4 half-days of observation. We observed private physicians during their lunch hour on each day of observation; because academic physicians were scheduled in half-day sessions, we did not observe them during their lunch time. In calculating physician productivity and the number of minutes spent actually working, we subtracted personal time, including lunch time, from the overall length of the private physicians' workday. We then divided the number of patients seen by the number of hours in the workday to determine the number of patients seen per working hour.

Several physicians left the office at the end of the clinic session or day and returned later to finish dictating chart notes on patients seen that day. Since we did not observe this delayed activity, we asked physicians to note the amount of time spent and then called them the following day to gather that information. The time spent on this delayed activity was added to the total work time for that day as time spent dictating. Time spent on intervening personal activities, such as going home for supper, was excluded.

We asked the office nurses to briefly explain the study and to ask permission from the patients for the research assistant to be in the room during the visit. To minimize the effect of the research assistant's presence on physician activity, we instructed physicians not to introduce the research assistant to patients, but most did. Those introductions took less than 1% of the physician's total work time.

Using paired *t* tests, we examined changes in total time spent at work and the number of patients seen per hour when a medical student was added to academic or private physicians' practices. Within each group of physicians, we compared how work time was used with and without a student, using descriptive statistics and paired *t* tests. In subgroup analyses, we also explored differences between academic and private physicians. In work-sampling studies, the observation is the unit of analysis.²¹ To make the presentation of our findings clearer, we used the physician as the unit of analysis; however, statistical significance was essentially the same whether we used the observation or the physician as the unit of analysis.

Results

When a student was present in the office, the private physicians spent more time at work than they did when the student was not present (Table 1). When we sub-

Table 1. Productivity of Private Family Physicians With and Without a Medical Student Present in the Practice

Physician Variables	Without a Student	With a Student	Change (95% CI)
Time at work, including lunch, min/d	521.2	548.6	27 (-9 to 64)
Time, actual working, min/d	457.0	508.9	52 (16 to 88)
Patients seen			
n/day	29.4	27.6	-2 (-7 to 3)
n/hour	3.9	3.3	-0.6 (-1.1 to -0.1)

tracted lunch and personal time and compared time actually spent working, there was a statistically significant difference of 52 minutes of extra work time per day ($P=.007$ by paired t test; 95% confidence interval [CI], 16 to 88 minutes). There was no significant change in the number of patients private physicians saw per day, but private physicians were significantly less productive when a student was present, with a decrease of 0.6 patients per hour ($P=.03$; 95% CI, -1.1 to -0.1). The academic physicians spent 6 minutes per day less time at work when a student was working with them, but this difference was not significant (95% CI, -67 to 55 minutes). The academic physicians saw on average 18 patients per day regardless of whether a student was in their practice, and their productivity (2.3 patients per hour) did not change when a student was added to their practice.

We recorded a total of 10,328 observations from both groups with no single physician-day contributing less than 0.9% or more than 1.6% of the observations. Of the 10,328 observations, 5645 (55%) were recorded while observing the 22 private practice physicians. Of these 5645 observations, 2865 (51%) were made when a student was present in the practice and 2780 (49%) were without a student in the practice. More than 80% of the observations of private practitioners were in the physician's office; most of the remaining observations were in the hospital (8.2% of those without and 12.4% of those with a student). A total of 4683 (45%) of the observations were with 12 academic physicians. These observations were evenly split between those that involved a medical student ($n=2353$) and those that did not ($n=2330$). Most observations of academic physicians (99.6%) were in the clinic; only 19 (0.4%) were in the hospital.

The Figure presents a summary of the number of minutes per day that academic and private physicians spent in various activity categories with and without a medical student present in the physician's practice. In both physician groups, the amount of time spent in patient-centered activities decreased significantly ($P<.03$) when a medical student was in the practice: 47.5 fewer

minutes per day for academic physicians and 27 fewer minutes per day for private physicians. The decreases occurred in seven of the 10 subcategories of patient-centered activity for each group of physicians (Table 2).

When a student was present in the physician's practice, academic and private physicians devoted 63 and 71 minutes per day, respectively, to student-centered activities. Time spent in various student-centered activities, which are listed separately in Table 3, were similar for the two groups of physicians. Among 17 subcategories of student-centered activities, the only significant difference between physician groups was in time spent socializing with the student. For the private physicians, this activity occurred primarily over lunch. Activities in which both the physician and student were actively involved, including providing feedback to the student or asking a question requiring analysis and synthesis, took less than 1% of both private and academic physicians' time.

With a student in their practice, private physicians spent 39.7 minutes per day in personal activities, compared with 64.3 minutes when a student was not present (difference of 25 minutes, 95% CI, 8 to 41 minutes, $P=.006$), primarily because part of the physician's personal time was reallocated to socializing with the student during lunch. Academic physicians had less personal time, since the half days during which they were observed did not include lunch. Thus, the presence of a medical student in their practices did not affect their personal time.

Administrative and paperwork activities took about 2 hours a day for both groups of physicians, regardless of whether a student was present, with essentially no change for private practitioners. Academic physicians spent 17

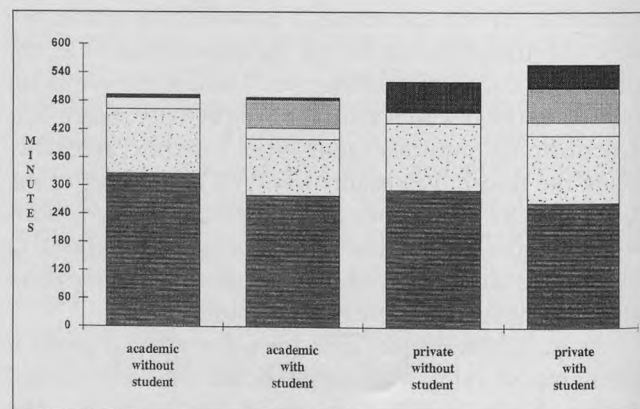


Figure. How family physicians in private and academic settings use their time at work with and without a medical student present in the practice. Reading from the bottom of the bars upward, the medium-gray shaded portion of the bars represents patient-centered activities; the speckled portion, administrative activities; the white portion, travel; the light-gray shaded portion, student-centered activities; and the dark-gray shaded portion, personal activities.

Table 2. Patient-Centered Activities of Academic and Private Family Physicians, by Presence of a Medical Student in the Practice

	Academic Family Physician		Private Family Physician	
	Without Student	With Student	Without Student	With Student
Physician activity, mean min/d				
Taking history	64	41	33	33
Conducting physical examination	55	34	48	44
Performing surgery/procedure	21	16	29	24
Talking with patient/family	111	92	99	111
Reviewing chart/laboratory result	54	42	32	23
Not being observed*	6	38	19	14
Engaged in two patient-care tasks	10	10	24	10
Getting drugs for the patient	1	1	4	3
Conducting literature search	3	4	4	3
Performing laboratory tests	1	.5	1	1
All	326.0	278.5	293.0	266.0

*Physician in private session with patient.

fewer minutes per day in administrative activities when a student was present, but this difference was not statistically significant. Most of the time spent in travel was walking within the office and accounted for 4% to 5% of both the academic and private physicians' time. Activities that we coded as miscellaneous occupied less than 1% of the physicians' time.

Students working with private physicians spent more time actively involved with the physician, either in patient-centered or student-centered activity than did students working with academic physicians. However, private physicians were more likely to have the student passively observ-

ing them, whereas academic physicians were more likely to have the student actively involved in patient care, ie, interviewing or examining a patient while the physician was in a separate room seeing another patient, rather than being directly involved with the physician-teacher.

In each group of physicians, the number of patients seen per working hour increased for one half the physicians and decreased for the other half. Comparing physicians whose productivity increased with those whose productivity decreased, we found a consistent pattern for both academic and private physicians. Those whose productivity increased were more likely to have the student

Table 3. Student-Centered Activities in Academic and Private Practice Settings

Activity	Academic Physician, mean min/d	Private Physician mean min/d
Teaching interaction between physician and student		
Physician feedback to student	1	2
Higher order question or discussion	2	2
Passive student involvement		
Physician demonstrating to student	3	0.2
Physician review patient with student	11	13
Physician lecturing to student	8	7
Active student involvement		
Student asking physician question	4	5
Case presentation by student	16	11
Student taking history	1	1
Physical examination by student	4	3
Surgery procedure on patient by student	1	3
Dictation by student	0.4	1
Student writing prescription	0.1	0
Student literature search	0.1	0.3
Student review chart/laboratory report	0.4	0
Student doing laboratory procedure	1	0
Other interaction between physician and student		
Administrative discussion with student	4	2
Physician socializing with student	1	19
Total*	58	69.5

*Totals do not equal the true totals (63 and 71, respectively) because of rounding errors.

passively observing and less likely to have the student working with a patient in another room than were physicians whose productivity decreased. For both academic and private physicians, comparing physicians whose productivity increased with those whose productivity decreased, there was no difference in the proportion of time the student was actively involved with the physician.

Discussion

Our findings confirm that private physicians work longer (52 additional minutes per day) when a medical student is present in their practice. This difference is quite close to the previously reported perception of family physician preceptors in the same program (46 additional minutes per day).³ The increased time is a result of a 27-minute longer workday and a shift from personal time to time spent socializing with the student during lunch (25 minutes). Although the latter probably is one of the intangible benefits of teaching that encourage private physicians to continue serving as volunteer faculty, we categorized it as work, since it included discussions about patients, career counseling, and mentoring. In addition, this time of socialization with students may have prevented physicians from pursuing personal activities.

When a medical student was present in the practice, both academic and private physicians spent significantly less time in direct patient contact. The decrease was found in most subcategories of patient-centered activities rather than in just one. We do not know whether the decrease in physician-patient contact had any effect on patient satisfaction or other quality-of-care components. The time students spent with patients independently may have quantitatively and, to some extent, qualitatively compensated for the decrease in direct patient contact by the physician. Academic physicians were able to maintain their productivity because of the shift from physician-provided patient care to student-provided patient care.

Our study was designed to detect a change in patient care productivity as measured by the number of patients seen per hour. Our previous survey showed that few preceptors perceived a change in the number of patients seen or in income when they taught a medical student.³ The current study did not include a measurement of dollars of business done per day. We found no significant change in the number of patients seen per day but did find a significant decrease in patient care productivity as measured by the number of patients per work hour.

We expected that the presence of a medical student in the practice would similarly lengthen the workday for academic physicians; instead, we found that it shortened their workday, although insignificantly, by 6 minutes.

The reasons for this finding are not clear, but we suspect that the academic clinic is geared for lower patient-care productivity to allow time for teaching. Faculty physicians have students with them at most clinic sessions, while most private practices we studied have only one or two students per year. With a schedule designed to accommodate students, fewer patients per hour would be seen at academic clinics. Thus, the presence of a medical student would be less likely to lengthen the workday of academic physicians.

In the work sampling portion of our analyses, we found few differences between academic and private physicians with regard to the types or quantities of teaching activities used. The most notable difference was that academic physicians allowed students to work with patients semi-independently more often, whereas private physicians favored having the student participate as a passive observer. Within each group of physicians, productivity increased more often when students operated less independently and more passively than for those whose students were given more independent roles in the practice. This finding, although somewhat tentative based on the post hoc analysis, tends to suggest that giving a student greater independence decreases a physician's productivity, as it requires time to listen to and review the student's presentation and time to examine the patient to confirm the student's findings.

Although the number of observations in our study was large, a limited number of physicians were observed for only a few days each. If, for example, we had used the private physician ($n=22$) as the unit of analysis rather than the observation ($n=5645$), our primary finding that the presence of a medical student in the practice increased the amount of work time for private physicians would have remained statistically significant. On the other hand, since our sample was one of convenience, including only family physicians who volunteer to teach medical students in Missouri, our findings may not be generalizable to other situations. In particular, we studied only fourth-year medical students working with family physicians for 4 weeks. Courses that involve students earlier in medical school or that have different lengths or arrangements of clerkship experiences may affect family physicians differently, and our findings tell us little about the effects of medical student teaching on other specialists.

The differences in productivity that we found may have been the result of differences in the number of patients who presented for care on the observations days and the nature of their problems. The number of observation days was limited, and a single complicated patient could have shifted the physician's productivity to a greater degree than the student's presence. However, since the number of patients seen changed minimally, we believe

the change in private physician productivity is real. Furthermore, our finding that academic physicians' productivity, measured in patients seen per hour, is less than that of private physicians is consistent with the findings of Garg and colleagues,¹⁰ who reported that academic physicians' productivity was 30% to 40% less than that of family physicians in nonacademic practice. This finding may be attributable in part to a schedule that takes into account the time demands of teaching.

If medical education is shifted from inpatient to outpatient settings, from specialty care to primary care, and from academic clinics to private offices, our findings may have important implications for medical schools and for private practitioners who volunteer their time. Since teaching takes time, our findings also may have implications for those who pay the costs of medical education and patient care.

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