

# The Impact of Working with Medical Students on Resident Productivity in the Emergency Department

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**Introduction:** Academic emergency departments (ED) strive to balance educational needs of residents and medical students with service requirements that optimize patient care. No study to date has evaluated whether resident precepting of medical students affects residents' clinical productivity. Understanding the interplay of these variables may allow for ED staffing that maximizes productivity. We sought to determine whether the precepting of medical students impacts resident productivity.

**Methods:** This study was performed at a tertiary care ED with a 70,000 annual patient census. We performed a computer-based (Verinet Systems, Alachua, FL) retrospective review of patient encounters initiated by second- and third-year emergency medicine residents (PGY2 and PGY3) assigned to medical student precepting shifts and compared these shifts with those of the same residents when not working with students. Data collection over 12 months included shift length from the monthly schedule and number of patients and relative value units (RVUs) from the Verinet System. Patients seen per hour (pt/hr) and relative value unit per hour (RVUs/hr) were calculated. We compared parameters using two-tailed t-tests. The hospital's institutional review board approved this study.

**Results:** Daily census was 202 on days without medical student rotators and 200 on days with student rotators ( $p=0.29$ ). While precepting students, PGY3s saw 1.40 pt/hr versus 1.39 pt/hr without students ( $p=0.88$ ) and PGY2s saw 1.28 pt/hr with students compared to 1.28 pt/hr without students ( $p=0.94$ ). PGY3s generated 3.97 RVU/hr with students and 4.03 RVU/hr while working independently ( $p=0.68$ ) and PGY2s generated 3.82 RVU/hr working with students versus 3.74 RVU/hr without ( $p=0.44$ ). There were no productivity differences between resident precepting shifts and regular shifts.

**Conclusion:** In this study, resident productivity was not affected by precepting medical students. [West J Emerg Med. 2013;14(6):585–589.]

## INTRODUCTION

Emergency departments (ED) are a setting where patient care and medical education occur simultaneously. As part of their education, emergency medicine (EM) residents learn to balance academic and clinical responsibilities. An area of growing interest is the evaluation of the interplay between these two integrally related facets of medical education, especially regarding the role of residents as teachers. In

addition to the inherent educational framework of residency wherein instructing others is a means of learning, the Accreditation Council for Graduate Medical Education requires all residency programs to provide evidence of “structured learning activities that demonstrates how the program supports the development of teaching skills.”<sup>1</sup>

A large body of literature has shown that instructing residents in educational methodology can improve residents'

teaching performance and attitudes toward teaching.<sup>2-7</sup> However, one study showed that residents have concerns that teaching and related activities (for example, precepting students) interfere with their ability to perform clinical duties, and that this concern was more marked among more junior residents.<sup>8</sup>

While no significant relationship exists between clinical productivity and teaching among EM faculty, to date no study has evaluated whether precepting medical students affects resident productivity, as measured by patients per hour (pt/hr) and relative value units (RVUs) per hour (RVU/hr).<sup>9-11</sup> Given that residents are not just active learners but also teachers of their fellow residents and students, it is important to understand how their clinical and teaching responsibilities are interrelated. In this study, we sought to assess whether resident productivity is impacted by teaching activities, and whether the impact is more marked on junior residents.

## METHODS

We performed a computer-based retrospective chart review of patients evaluated in the ED by second (PGY2, n=12) and third (PGY3, n=12) year EM residents in a university-affiliated community-based ED with a 70,000 annual patient census, from September 2009 to June 2010. We used resident schedules to determine which residents were scheduled for which shifts (7AM–5PM, 12PM–10PM, 2PM–12AM, 4PM–12AM, and 1PM–9PM), and this was cross-referenced with the Verinet System (LightSpeed Technology Group, Inc. © 2004-2012), an independent system used in our ED for tracking, coding, patient encounters, and other departmental metrics. Residents were assigned to between 1 and 3 medical student precepting shifts on their monthly schedule, and this information was also recorded. During these entire shifts, a resident is assigned to a medical student. In addition to informal bedside teaching, residents hear presentations from medical students, review patients' radiographic and laboratory studies, and discuss differential diagnosis and care plans. Residents also provide verbal and written feedback. No more than one medical student is scheduled to work with a given resident.

All patients seen by residents must be presented to an attending physician, who then sees the patient, regardless of whether or not a student is involved in care. There are no specific standards or guidelines by which residents use students in this ED. All residents worked both precepting and non-precepting shifts. We excluded night shifts from data collection as students were not scheduled to work overnight.

We queried the Verinet System to determine the number of patients seen and number of RVUs generated by residents during clinical shifts, and from this we calculated patients per hour and RVUs per hour. The daily census was also recorded from the Verinet system to determine if patient volume contributed to productivity.

First-year residents were excluded, as they do not precept medical students. We excluded shifts if Verinet documented

no patients seen that day, as the resident had likely traded out of the shift. Shift trades in which the residents did not change the names on their computerized and paper schedule were excluded. If the residents traded shifts and the change was verified on the schedule, the traded shift was included.

Data were entered into an Excel spreadsheet (Microsoft, Redmond, Washington) by trained data abstractors who were not blinded to the resident groups. We analyzed numerical data using descriptive statistics. A chi-square analysis was performed to determine that residents worked similar proportions of day and evening shifts with students and without. Two-tailed t-test compared daily census data to determine if differences in volume contributed to resident productivity with and without medical students. We evaluated the calculated values for pt/hour and RVUs/hour as a function of both resident level of training and presence or absence of medical student precepting. These parameters were compared using two-tailed t-test for normally distributed data. The institutional review board reviewed and approved this study.

## RESULTS

Ninety shifts when residents were precepting students and 618 shifts without were included in this study. The mean daily census with student rotators was  $200 \pm 25.9$ , versus  $202 \pm 24.5$  without ( $p=0.29$ ). Residents worked a similar proportion of day and evening shifts with and without students (chi-square  $p=0.18$ ).

### Intraclass comparisons

PGY3s saw a similar number of patients whether or not they were working with students (1.4 versus 1.39 pt/hr,  $p=0.88$ ) and generated a similar number of RVUs (3.97 versus 4.03 RVUs/hr,  $p=0.68$ ). PGY2s also saw a similar number of patients regardless of whether they were working with students (1.28 versus 1.28,  $p=0.94$ ) and generated a similar number of RVUs (3.82 versus 3.74,  $p=0.44$ ).

### Interclass comparisons

While precepting medical students, PGY3s saw 1.40 pt/hr (confidence interval [CI] 1.27-1.53). Their PGY2 counterparts saw 1.28 pt/hr (CI 1.22-1.34,  $P = 0.07$ ). While working with students, both groups generated similar RVUs, with the PGY3 residents generating 3.97 RVU/hr and the PGY2 residents generating 3.82 RVU/hr ( $P = 0.39$ ).

While working independently, PGY3s saw 1.39 pt/hr (CI 1.25 – 1.54), while PGY2s working independently saw 1.28 pt/hr (CI 1.20 – 1.36,  $P = 0.10$ ). PGY3s working independently generated 4.03 RVUs/hr, and PGY2s working independently generated 3.74 RVUs/hr.

## DISCUSSION

In our study, PGY2 and PGY3 residents showed no difference in productivity whether working alone or precepting a medical student. This is somewhat surprising,

given numerous previous studies showing that PGY3 residents are more productive than PGY2 residents.<sup>12-16</sup> Certainly one would hope that productivity increases over the course of training, so that residents are ready to handle the workload of a busy ED when they graduate. The fact that productivity did not differ in this case may be related to PGY3s intentionally carrying lighter patient loads to facilitate the training of their more junior peers. (In other words, they were pushing PGY2s to see more patients.) Additionally, this may be evidence of unmeasured systems issues within the study center that potentially prevent residents from being more productive as they advance through training. Or it may be a factor of senior faculty physician availability, as a resident cannot turn over a bed without presenting the patient to a senior faculty physician, who then must also see the patient.

It would stand to reason that an additional responsibility, such as precepting a student, would create more work for a resident and reduce his or her productivity. Since both teaching and providing patient care require time, as one spends more time teaching, one has less time to see patients. Studies have found that productivity in senior faculty physicians is not inversely related to the quality of teaching they provide in academic institutions.<sup>9-12</sup> However, these studies performed at teaching institutions have relied upon resident, student, and faculty perceptions of teaching interactions and have used regression or mixed-effect models to determine relationships between teaching and productivity. They have not directly compared individual practitioners' productivity while teaching as compared to while they have not been teaching. Other studies done during resident work strikes have shown that academic EDs have faster turnaround times when there are no residents, and practices that had been community-based become less productive with the introduction of residents.<sup>16-20</sup> This is likely not merely a byproduct of attending physicians taking time to teach residents, but also a result of slower care that is rendered by less experienced trainees as they develop their diagnostic, procedural, and multitasking skills. Based on these studies that show productivity decreases with introduction of new learners, it is expected that resident productivity should fall when less experienced medical students are added to the patient care team.

Our study did not show this. It is possible that the time taken to teach and precept students is balanced and offset by the contributions of students to a residents' clinical duties, thereby resulting in a net neutral time balance. In our department, each student performs the initial assessment of his or her patient. While the student does this, the resident often sees another patient independently in order to not waste time. The student then presents his or her patient to the resident. While the resident performs an assessment of the student's patient, the student is often charged with finding and interpreting old records, reporting lab values and radiographic studies, and re-evaluating patients (for instance, giving patients routine updates or assessing adequacy of

pain control). It is likely that these contributions save time that would otherwise have been spent by the resident on these tasks, thus freeing up residents for teaching students or picking up additional patients. It is also possible that residents find additional time for teaching students when they would ordinarily be doing other tasks, such as documenting, and that they may then delay their documentation until after completion of their shifts. Perhaps residents are more proficient at managing their time on days when they have students and simply exercise a higher degree of multi-tasking, integrating teaching into the tasks they are already performing.

Another possible reason productivity is unaffected by precepting students is that pt/hr and RVUs/hr are partly dependent on a critical volume of patients waiting to be seen. It is possible that there were times for both precepting and non-precepting shifts when a resident's productivity was limited by a lack of available patient encounters. Our precepting shifts were limited to day shifts when, although there is a generally high volume of patients, there is also a maximum of resident coverage. Perhaps repeating this study during night shifts – when there are patients awaiting evaluation a larger proportion of the time – would yield different results. Whether precepting students would enhance or detract from productivity in this scenario is a matter of speculation. It is conceivable that their contribution to performance of ancillary tasks could increase overall productivity in the setting of more consistently available patient encounters, but it is also possible that time spent teaching them could result in a productivity decrease. There is also the chance that it may make no difference at all, as patient volume and time may not be the limiting factors for productivity. Senior faculty physician availability, nursing responsiveness, and systems issues may also be key contributing factors.

Regarding ED staffing, this study suggests that PGY2 and PGY3 EM residents are equally suited to manage the clinical duties required during an ED shift and precept a medical student without adversely affecting productivity. Thus, no additional accommodation needs to be given to scheduling residents to ensure that they are not working with students during peak ED hours. This suggests that students can be scheduled for day or evening shifts with no untoward effects.

## LIMITATIONS

There are several limitations to this study. We may not have adequately controlled for patient acuity. Clearly, acuity level could influence productivity comparisons, and it is possible that residents of different levels of training or residents working with students might gravitate toward differing levels of acuity. Although at our institution it is the policy that residents see patients in the order in which they arrive to the ED within their given acuity level, there are occasions when residents might "cherry-pick" through charts. We did attempt to limit the impact differences in acuity would

have on our data analysis by incorporating RVU data into our analyses, in addition to patients seen per hour.

Another limitation involves the use of RVUs in our analysis. Although generally accepted as a reasonable productivity standard, RVU scores are highly dependent on patient length of stay and on the documentation done by the residents. Our residents do undergo documentation training, and all their documentation is reviewed by the attending physician. However, it is possible that residents of different levels of training document with different proficiency, which may introduce potential bias.

Additionally, we did not explore patient length of stay in this study. Our focus was primarily on resident productivity, and we found no differences in any productivity parameters among or between PGY2s or PGY3s. However, there may be an unappreciated impact of precepting medical students on resident efficiency, or residents' ability to move the patients they pick up through the ED and disposition them in a timely fashion. This would be an area for further study.

Although both precepting and non-precepting shifts took place in the same ED with similar patient volumes and similar staffing, there may be fluxes in inpatient bed availability or nursing staffing, both on the inpatient wards as well as in the ED, for which we did not control. Throughput, efficiency, and productivity are very complex parameters, and there is no way to control for all the variables that affect them. Our focus was on measures of productivity that have been used in the literature in prior studies to perform an initial exploration of the impact medical students have on these measures. This study is in no way meant to be a comprehensive assessment of all the other factors that impact productivity at academic institutions.

We did not attempt to control for the number of patients "handed off" at change of shift. These patients could theoretically impose a burden on a resident, causing reduced productivity on a given shift.

Our study did not evaluate medical student perceptions of the quality of teaching and feedback they received from residents. It is possible that although PGY2 and PGY3 residents were equally productive that one group was more effective at teaching than the other. Future evaluations of student perception of teaching are important, as medical student ED rotations have been shown to strongly impact their interest in EM.<sup>21</sup>

Finally, our data were drawn from a single institution and may not be able to be generalized to other institutions.

## CONCLUSION

In this institution, resident productivity was not affected by precepting medical students. PGY2 and PGY3 emergency medicine residents are equally capable of precepting medical students without changing their clinical productivity on day and evening shifts.

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**Conflicts of Interest:** By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. The authors disclosed none.

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