Many educators view residency teaching clinics as the heart of family practice and primary care internal medicine training programs. It is in these training clinics where residents develop their ambulatory practice habits. Yet, little is know about the efficiency of these teaching clinics.

**Background:** Teaching clinics are the heart of training programs in family practice. It is in these training clinics where residents develop their ambulatory practice habits. Yet, little is known about the efficiency of these teaching clinics.

**Methods:** We conducted a time-and-motion study of patient flow in a residency teaching clinic. During each half-day session, 7.8 ± 1.9 providers were scheduled in clinic, and 55.5 ± 12.9 patients were seen. First-year residents saw 3.55 patients per half-day session, second-year residents saw 4.75 patients, third-year residents saw 8.0 patients, faculty saw 8.22 patients, and urgent care saw 8.35 patients. The number of patients scheduled was highly correlated with the number of providers in clinic. Of the patients scheduled, 25% failed to keep their appointment, and 31% arrived late. Neither rates of no-show patients nor rates of late patients varied by level of provider. The mean time patients spend in the clinic was 80.5 ± 30 minutes, with 17 ± 10 minutes spent registering, 18 ± 17 minutes spent being roomed, and 19 ± 16 minutes spent waiting for the provider. The physician spent 27 ± 16 minutes with the patient, including both face-to-face time and precepting time. Patients who arrived on time waited significantly longer than those who arrived late. Waiting time did not vary significantly by level of physician. The time patients spent with their doctor did vary significantly by level of physician; first-year residents spent more time with their patients than upper-level residents or faculty.

**Results:** Significant variation exists in the patient flow through the clinic. Patient volumes are significantly correlated to the number of providers in clinic. Long waiting times are due in part to long processing times and in part to long waits in the exam room. Concerted multidimensional efforts are needed to smooth out patient flow and improve clinic efficiency.

**Conclusions:**

Significant variation exists in the patient flow through the clinic. Patient volumes are significantly correlated to the number of providers in clinic. Long waiting times are due in part to long processing times and in part to long waits in the exam room. Concerted multidimensional efforts are needed to smooth out patient flow and improve clinic efficiency.

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Many educators view residency teaching clinics as the heart of family practice and primary care internal medicine training programs. It is in these training clinics that primary care residents develop their ambulatory practice habits. The clinical efficiency and financial viability of these training clinics has been a concern since the early 1980s. In 1984, a study of 15 Robert Wood Johnson-funded residency teaching clinics found serious inefficiencies in their use of space, clinician time, and support staff. These inefficiencies translated into difficulty for patients getting appointments, long waiting times in clinic, and low patient satisfaction. Over one 2-year period, 50% of the clinic’s patients stopped using the residency clinic for their primary care services. Nevertheless, because resident salaries are low relative to physician pay, these clinics approached financial breakeven, and when a portion of the revenues from ancillary services was included in the calculation, the clinics generated revenue for their parent hospitals. Because of the low pay scale for residents, researchers have further suggested that the resident-staffed teaching clinics are a more cost-effective strategy for providing care to the predominantly indigent patients served by these clinics than staffing the clinics with faculty physicians.

Recently, however, a number of changes have occurred in the medical environment that affected or are affected by the financial performance of these training clinics. First, regulation has required higher ratios of faculty to residents than was previously recommended. Historically, only 30% of the patients seen by senior residents were also interviewed or examined by faculty. Now, however, some insurers require that faculty see all patients (personal communication, State of California MediCal Program).
Second, with the reductions in Medicare funding for graduate medical education, larger portions of the cost of the resident training programs must be paid from the clinical income generated by the residency training clinic. If clinical income is inadequate, the finances of the training programs might be jeopardized.

Third, the Residency Review Committee (RRC) for Family Practice has recently modified the requirement for outpatient care so that residents are required to see specified numbers of patients rather than simply spending specified numbers of half days in clinic. Third-year residents are now required to see 1,000 patients in their third year. Residents can achieve this goal by seeing an average of eight patients per half day for 3 half-day sessions per week for 42 weeks during the year. Unfortunately, with the current inefficiencies in residency training clinics, the average patient volume for third-year residents and faculty has been reported to be six patients per half day. Residency training clinics may be required to increase their patient volume by 33% just to meet the new educational requirements.

Our residency-based teaching clinic in Sacramento, like those described in the national studies, has also had problems with inefficiency. These inefficiencies manifest themselves as reduced patient access to appointments, problems with patient flow, prolonged patient waiting times, and decreased patient satisfaction. Numerous corrective strategies have been tried, such as hiring faculty whose role was predominantly clinical care, changing physician’s templates, and “front-loading” the physician’s schedule by scheduling patients more heavily in the early part of a clinic schedule. None of these interventions improved patient access or patient waiting times. The front-loaded schedule, where all patients were scheduled for the first 2 hours of a 4-hour clinic schedule, did, however, result in clinics ending on time and decreased the nursing overtime pay.

Last year, our family medicine teaching clinic had 27,000 patient visits and, if properly organized, could be an extremely valuable educational resource. Over the last several years, however, anecdotal comments from faculty and residents suggest that time spent in the clinic is more of a burden than of value. Believing that complex, multidimensional issues are at the root of the clinic’s patient flow problem, a multidisciplinary group of faculty and staff gathered in July 1998 to better understand and address the problems with clinic efficiency.

This paper reports on one component of the efforts to understand and address the clinic’s inefficiency. It reports the results of a time-and-motion study that more completely described the volume and flow of patients and doctors within our family medicine teaching clinic. This study represented one part of our multidimensional approach to improve the functioning of our department’s teaching clinic.

Methods

Description of Clinic

The teaching clinic is comprised of a single reception area and three physically distinct clinical care delivery “pods.” The front desk area in the clinic is staffed with five desk staff who are responsible for registration, patient check-in, collection of copayments, patient checkout, and scheduling of follow-up appointments.

Pod #1 has seven exam rooms, pod #2 has eight exam rooms, and pod #3 has nine exam rooms. Each pod is typically staffed by two nursing personnel (one licensed vocational nurse and one medical assistant). The nursing personnel put patients in rooms, obtain chief complaints, obtain medication lists, take vital signs, administer immunizations, and assist with pap/pelvic exams. Pod #1 is used for an urgent care clinic and is staffed by two providers for each half day. Pods #2 and #3 are used for resident and faculty continuity clinics. The number of providers scheduled in these two pods is based on provider and room availability.

In addition to the staff described above, we have a phone room with two full-time equivalent (FTE) clerical staff who answer telephones and schedule patient appointments. We also have a registered nurse phone triage room where 2.5 FTE registered nurses answer patients’ clinical questions using established phone protocols, schedule appointments when necessary, and handle medication refill requests. The clinic also has one FTE referral coordinator who handles all authorizations and referrals for subspecialty care or radiological procedures. A part-time medical director, a clinic supervisor, a clinic manager, and a nurse manager oversee the operations of the clinic. Appointments can be scheduled by the front desk staff, the registered nurse phone triage staff, or the phone room staff.

First-year residents have four 30-minute patient appointment slots per half day, second-year residents have eight 15-minute appointment slots per half day, and third-year residents and faculty both have eleven 15-minute slots available for scheduling patients. For all providers except first-year residents, extended visits are scheduled using two slots for the following types of visits: new patients, well-woman exams, well-child exams, and new obstetrical patients.

Patients are reminded of their appointments by a mailing that is sent to their home from a central location in the health system. No formal system of appointment reminders existed at the clinic level at the time of the study.

Description of Study

A 1-week time-and-motion study was performed in our family medicine teaching clinic during April 2000. Data were collected on all patients seen in the clinic during the study week. Existing clinic personnel were used to collect the data. The nursing group took on a leadership role to ensure complete data collection.
Patients, when they checked into the clinic, had a data collection form attached to their registration information. Front desk staff noted on this form the time the patients arrived in the clinic, their appointment time, the pod # where they were to be seen, and the name of their provider. The form went with the patient’s chart through the clinic, and the nurses and the physicians recorded the times when various activities occurred. The forms were collected by the nurses at the end of the patient visit, and the time the patients left the clinic was noted. Provider names were coded according to the level of provider (first-year resident, second-year resident, third-year resident, faculty, nurse practitioner) at the time of data entry into the computer.

Outcome measures included (1) clinic volume and staffing characteristics and (2) patient flow measures. Clinic volume and staffing characteristics were collected for each half-day session and included number of patients scheduled and number of patients seen by each provider, pod location of each provider in clinic during the half-day session, level of training of each provider, number of nursing personnel in each pod during each half-day session, total patient volume in each pod, total number of providers in clinic for each half-day session by provider type, and number of faculty preceptors present. Patient flow measures were calculated by subtracting the actual time of the day that patients arrived at certain points in their clinic visit. For instance, registration time was calculated by subtracting the patients’ arrival time from the time they had completed registration, and the chart was passed on to the nursing staff to room the patient. Waiting room time was defined as the time from when registration was complete until the time the patient was in the exam room and ready to be seen by the doctor. Exam room wait was the time from when the patient was ready to see the doctor until the time the physician actually entered the room. Time with the doctor was time from when the doctor entered the exam room until the time the patient left the office (and included precepting time). Total time in the clinic was the time from when the patient arrived subtracted from the time the patient left the clinic. Patients were determined to be late if their clinic arrival time was after their scheduled appointment time.

Data Analysis

Data were entered as the actual times the events occurred. Waiting time was calculated using mathematical functions in a Microsoft Excel® spreadsheet. Calculations where one of the data elements was missing were deleted since the results given by Excel were nonsensical. For instance, if patients’ arrival time was noted, but the time they finished registration was missing, then the calculation produced a large negative number, since Excel assigns a value of zero to all missing values. Alternatively, if the time the patient’s registration was completed was entered, but their arrival time was missing, then the calculation generated a large positive number that was also nonsensical, since Excel assigned a value of zero to missing data. The results where one element needed for the calculation was missing were eliminated from the results and not included in the final analysis; however, the patient’s other calculations were not excluded from the analysis. Of the 555 patients seen during the study week, the number of missing data elements varied for each variable. Registration time had 472 valid observations, waiting room wait time had 446 valid observations, waiting time in the exam room had 418 valid observations, time spent with the physician had 407 valid observations, total waiting time had 348 valid observations, and total clinic time had 304 valid observations. Data on the time spent with the preceptor had too many missing values to be used as a separate variable in the analysis.

Data was then transferred for statistical analysis to SPSS-® Windows®. Results were computed for each half-day clinic session. Categorical variables were compared using chi-square statistic: such variables included percent of late and no-show patients by level of provider. Continuous variables were compared using t tests or ANOVA for normally distributed data, such as number of providers in the clinic, number of patients scheduled, number of patients seen. Waiting time data, time spent with the physician, and total time in clinic were analyzed for overall significance using Kruskal-Wallis nonparametric tests. Post-hoc subgroup analysis of waiting time data, total clinic time data, and time with physician data was performed using ANOVA and least-squares difference post-hoc testing. Missing data were not included in the analysis.

Results

A total of 78 provider half days were scheduled during the week studied. For the week studied, the distribution of provider half days in the clinic was 15% first-year residents, 17% second-year residents, 31% third-year residents, and 37% were providers that included faculty, family nurse practitioners, or physician assistants. The number of providers in the clinic per half day was 7.8 ± 1.9 (range 6 to 11). For 60% of the half-day sessions, six or seven physicians were scheduled for clinic, and for 40% of the half-day sessions, eight to eleven physicians were scheduled for clinic. The number of patients scheduled for the clinic per half-day session was 69.5 ± 13 (range 61 to 100). The number of patients seen in the clinic per half-day session was 55.5 ± 12.9 (Figure 1).

The volume of patients scheduled for any given half-day session was directly related to the number of providers in the clinic (rho=.811, P<.01). The number of patients seen by first-year residents was 3.55 patients
per half-day session. Second-year residents saw 4.75 patients per half-day session, third-year residents saw 8.00 patients per half-day session, faculty saw 8.22 patients per half-day session, and urgent care clinic, staffed by nurse practitioners and physician assistants, saw 8.35 patients per half-day session.

The percentage of patients who did not keep their appointment was 25% ± 11% (range 7%–44%). There was no significant difference in the percentage of patients that did not keep their appointment between faculty, residents, or drop-in clinic (F=1.01, P>.1). The percentage of patients that arrived late for their appointment was 31%. There was no difference is the percentage of patients who were late according to level of provider (first-year resident-faculty, X^2=2.9, P=.57).

The time spent by patients in the clinic was 80.5 ± 30 minutes. Patients spent 52.5 ± 26 minutes registering, waiting in the waiting room, being escorted to an exam room, and waiting in the exam room to see the physician. Patients spent 27 ± 16 minutes with the physician. From the time a patient arrived in the clinic until the time they finished the registration process consumed 17 ± 10 minutes. From the time registration was complete until the patient was escorted to a room and ready to see the physician took 18 ± 17 minutes. From the time patients were ready to see the physician until the physician entered the room was 19 ± 16 minutes.

The patient time with the physician (X^2=47.7, P<.01) and total clinic time (X^2=21.1, P<.01) varied according to the level of the provider (Figure 2). The time spent with the doctor in urgent care clinic was the shortest (mean=23 minutes), and post-hoc analysis showed it to be significantly shorter than the time spent with resident physicians of any level (P<.01 for first-year resident/second-year resident, P<.05 for third-year residents) but was not significantly different from the time patients spend with the faculty (P=.187). The time patients spend with first-year residents is significantly longer than all other provider types (P<.01, compared with third-year residents/faculty/drop-ins; P<.05, compared with second-year residents).

The total time spent in clinic was shortest for urgent care patients (mean=73 minutes). Post-hoc analysis showed that total time spent in the clinic was significantly shorter for faculty patients and urgent care patients and significantly longer for first-year residents and third-year residents. The total waiting time (X^2=6.0, P=.199) and registration time (X^2=5.27, P=.26) were not significantly different among types of providers.

The total waiting time was noted to be 8 minutes shorter for those patients who arrived late (F=9.25, P<.01). The waiting times trended toward being shorter on days when fewer providers were in the clinic (rho=.204, P=.068).

**Discussion**

Even though we began this project by trying to improve patient waiting times, we found more fundamental problems that needed to be addressed before we could improve on waiting times. The problems include scheduling more than 50 part-time physicians to cover a five to six FTE provider clinic, without introducing significant variability in patient volume from one half day to the next. This scheduling issue will need to be addressed in a way that the clinic is sufficiently busy to generate a reasonable level of clinical revenue, to meet accreditation requirements for patients seen per resident, and to exhibit adequate operational efficiency so that patient waiting times are kept within acceptable ranges.

**Patient Volume**

For our clinic, the goals for patient volume are 30,000 patient visits per year. This means seeing 60 patients per clinic half day. Our data showed that daily patient volume is highly correlated with the number of physicians who are scheduled to be in the clinic. Increasing clinical volume can be achieved by simply increasing the average number of physicians scheduled in the clinic. Specifically, our clinic used its 24 exam rooms to see an average of 55 patients per half-day session. Our clinic averaged 7.8 physicians in clinic per half day, and each physician saw an average of 6.8 patients per half day. This patient volume was comparable to
the patient volumes described by previous research. However, this patient volume may be insufficient because third-year resident physicians seeing eight patients per half day achieve RRC requirements only if the resident spends at least 125 half-day sessions per year in clinic, and faculty seeing eight patients per half day are unlikely to generate sufficient revenue to support the time they spend in clinic. Viewed another way, our clinic sees only 2.2 patients per exam room per half day, an inefficient use of clinic space. With our 24 exam rooms, we have the space to consistently schedule eight physicians with three exam rooms or up to 12 physicians with two exam rooms each.

Increasing the average number of physicians in clinic from the current level of 7.8 to 9 per half day by adding one third-year or faculty provider per half day would achieve our patient volume goals. We would exceed our internal targets of 60 patients per half day or 30,000 patient visits per year. The first step to reaching this goal, however, is to eliminate the wide variation in the number of physicians scheduled in clinic for any given half-day session.

Scheduling of Physicians
Scheduling a consistent number of physicians in a residency teaching clinic for each half-day session is a difficult task. If we assume that our target is to schedule 8–11 physicians into clinic per half day, we were within range during only 40% of the half-day sessions studied. The residents historically are scheduled into clinic around their educational rotations. Our data suggested, however, that addressing the scheduling problem is not impossible since the first- and second-year residents combined provide less than one third of the clinic’s provider half-day sessions. Faculty and third-year residents, whose schedules are more within the control of the department, provided nearly 70% of the clinic’s provider sessions. Nevertheless, it requires the full agreement and concerted efforts of the clinic leadership, the residency program leadership, and the individual faculty members to achieve the targeted number of physicians in clinic for each and every half-day session. Achieving this goal would, however, help alleviate some problems of appointment availability for patients since we will be increasing the number of physicians in clinic by approximately 20%.

Waiting Times
In our clinic, it was noted that waiting times tended to increase as the number of physicians in clinic increased. This probably resulted from the fact that the number of staff scheduled to work at the front desk and at the nursing pods was relatively constant regardless of the number of physicians in clinic. Since the number of physicians in clinic changed from one half-day session to the next on an almost randomly appearing basis, the workload of existing staff varied in what seemed to be a random way. At times during this 1-week study, the patient volume would double from one clinic session to the next and exceed the ability of our clinic to adjust. It is really no surprise that under these circumstances, waiting times tended to increase.

Staffing
In a resident teaching clinic, the staffing differs from that of a private practice office. Multiple physicians (typically four to six) are scheduled to work with two members of the nursing staff, and each physician sees only four to eight patients per half day, and the patients are scheduled for simultaneous time slots. As a consequence, the patients arrive in waves. If 10 physicians are in clinic, and each physician has a patient scheduled at 8 am, our five front desk staff must each process two patients just to get the physicians started with their first patient. In our clinic, it takes 35 minutes to register and get each patient into a room, so physicians may wait 40 minutes before their first patient is ready to be seen. This results in a waste of personnel time and expense, with physicians being paid and available but not actively providing patient care. Faculty and residents have in the past used this lag time to do other academic work. They arrive late to clinic, and their actions inadvertently undermine efforts by the staff to improve the patient flow process.
Managing this complex patient flow is likely to require significant changes in the clinic structure, patient scheduling templates, and roles of the teaching faculty. These multiple changes in clinic processes will not happen without a concerted effort from all parties involved: the faculty, the residents, the nurses, and the front desk staff.

**Addressing the Problem**

In our clinic, we have developed multidisciplinary teams to address these various problems. One team is charged with smoothing out the number of physicians in clinic for each half day, with a target of 8 to 11 doctors in clinic 85% of the time. Another team has been charged with the responsibility of developing strategies for improving the process for registering patients. A third team is looking at physician templates to develop strategies to address the bottleneck of having large numbers of patients arriving all at once for their appointments. A fourth team is looking at optimum preceptor-to-resident ratios that will result in the preceptor being able to achieve the multiple precepting tasks described by Zweig of education, patient care, and revenue generation.\(^5\)

We are optimistic, even though these problems are clearly difficult. With an understanding of how complex the solution set is, it is no surprise that the problem of residency teaching clinic efficiency continues to be so intractable. Solutions to these problems will require leadership from all groups, including faculty, residents, nursing staff, and clerical staff. Any solutions that result will, of necessity, arise from the efforts of multidisciplinary teams and will likely emerge as new processes that are specifically designed for these unique clinical settings.

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