Comparison of Student Productivity in Four-Handed Clinic and Regular Unassisted Clinic


Abstract: Although four-handed dentistry is routine in most dental practices in the United States, solo unassisted clinical practice is the norm for students at many North American dental schools. The objective of this study was to compare the clinical productivity of fourth-year dental students practicing in a four-handed model to the clinical productivity of those same fourth-year dental students practicing in a solo, unassisted mode at the University of Iowa College of Dentistry for the three academic years 2005–08. Students averaged 2.62 patient visits per day in the four-handed Dental Auxiliary Utilization (DAU) Clinic and 1.74 visits per day in the regular Family Dentistry Clinic. Charging fees that are approximately 50 percent of prevailing local private practice fees, the mean daily charges for services provided by individual students averaged $329 in the DAU Clinic and $190 in the Family Dentistry Clinic. The mean daily productivity differentials were 0.88 patient visits and $139. While students averaged 51 percent more patient visits and 75 percent higher charges daily in the DAU Clinic as compared to the regular Family Dentistry Clinic, the increased revenues might not be sufficient to offset increased expenses incurred in the four-handed clinical operation.

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The roles of dental practitioners and dental auxiliaries have evolved considerably since Dr. C. Edmund Kells spoke in 1887 to “enumerate a lady assistant as of the greatest advantage to the busy practitioner.” Dr. Kells, who is usually credited with having hired the first dental assistant, recognized that working with a dental assistant could result “in such an increase of practice as to quite overreach your individual capacity, notwithstanding the methods adopted and the most perfect systematizing of the smallest details, whereby absolutely no time will be unnecessarily lost.”

Sit-down, four-handed dentistry arose as a solution to the dental human resource shortage in the mid-twentieth century. Time and motion studies in the late 1950s contributed to the improvement of the efficiency of dental practice. The term “four-handed dentistry” was first recorded in the proceedings of a conference on “Training Dental Students to Use Chairside Assistants” in 1960. According to Chasteen, the term evolved over the years to represent an entire concept of delivering dental services, consisting of four basic principles:

1. operating in a seated position,
2. employing the skills of trained dental auxiliaries,
3. organizing every component of the practice, and
4. simplifying all tasks to the maximum.

Chasteen suggested there were two principal benefits of four-handed dentistry: making the dentist’s, hygienist’s, and dental assistant’s work easier, by minimizing stress and fatigue, and increasing the productivity of a dental practice while maintaining high standards of quality.

According to American Dental Association practice survey data, the annual growth rate in U.S. dentists’ productivity was 3.95 percent per year from 1960 to 1974 and 1.05 percent annually from 1991 to 1998. Beazoglou et al. reasoned that the 1960–74 increase occurred “as dentists moved to high-speed drills and the greater use of auxiliaries” and that the 1991–98 increase resulted as “the general economy improved and dentists responded by employing more auxiliaries and increasing the size of their offices.”
Although four-handed dentistry is routine in most dental practices in the United States today, solo unassisted clinical practice is the norm for students at many North American dental schools. From the 1960s through the 1980s, federal dental auxiliary utilization (DAU) grants in the United States provided funding to train dental students to use chairside assistants and to operate in an efficient and comfortable sit-down manner, and most U.S. dental schools developed DAU programs. However, these grants were eventually phased out, and, as cost containment became a major factor in dental school budgets, these programs were scaled back or discontinued in many dental schools.

In the 1995 Institute of Medicine (IOM) report *Dental Education at the Crossroads: Challenges and Change*, the Committee on the Future of Dental Education reported that “financial and other constraints mean that many students receive an inadequate education in effective and efficient team practice with dental hygienists, assistants, and technicians.”

The Commission on Dental Accreditation’s most recent Accreditation Standards for Dental Education Programs specify that “administration, faculty, staff, and students are expected to develop and implement definitions, practices, operations, and evaluation methods so that patient-centered comprehensive care is the norm” and “teamwork and cost-effective use of well-trained allied dental personnel are emphasized.” Standard 2.19 stipulates that “graduates must understand the basic principles and philosophies of practice management and have the skills to function successfully as the leader of the oral health care team.”

Although previous reports have confirmed that four-handed dentistry increases clinical productivity in private practice office settings and in large clinics, the impact of four-handed dentistry on clinical productivity in a dental student clinic has not been well documented. The objective of this study was to compare clinical productivity of fourth-year (D4) dental students practicing in a four-handed model to the clinical productivity of those same fourth-year dental students practicing in a solo, unassisted mode.

## Methods

Four-Handed Dentistry in Clinical Practice (Advanced DAU) is a required one-credit hour course in the final year of the D.D.S. program at the University of Iowa. The program provides senior dental students with the clinical opportunity to become familiar with delivering dental care to patients while utilizing a trained chairside dental assistant. Educational objectives of the program include teaching treatment delivery techniques, patient and operator positioning, instrument selection and transfer, time management, interpersonal communication skills, and personnel management.

The clinical structure of the Advanced DAU program was reorganized to its current format at the start of the 2005–06 academic year. Since then, all D4 students rotate through the Advanced DAU program for an uninterrupted two-week assignment. The students treat patients five days per week in a morning (two-and-one-half-hour) and an afternoon (three-and-one-half-hour) session each day. Contrasted with the solo, unassisted clinical practice of students in the regular D4 (Family Dentistry) clinic, the DAU Clinic also features a lower student-to-faculty ratio, shorter patient appointments, and relocation of the participants together in a designated student group practice area of the Family Dentistry Clinic with new, state-of-the-art dental operatory equipment.

Students receive structured feedback from program faculty and dental assistants every day throughout their rotation through the Advanced DAU program. The final grade for the course is determined by individual student clinical productivity (50 percent of final grade), criteria-referenced evaluation by the program faculty (20 percent) and the dental assistants (10 percent), a written assignment of composing a job description for a dental assistant (10 percent), and a written examination (10 percent).

This study compared student clinical productivity in the four-handed (DAU) clinic to student clinical productivity in the solo, unassisted (Family Dentistry) clinic for the three academic years 2005–08. The number of patient visits and charges for clinical services rendered by each D4 dental student were tabulated daily throughout each academic year.

D4 students at the University of Iowa College of Dentistry are assigned to the Family Dentistry Clinic for approximately 130 days and to the DAU Clinic for nine and one-half days (two full weeks, with one half-day of orientation). Students are allowed eight “personal days” throughout the year, to be utilized at their discretion for such matters as personal illness, family emergencies, and interviews. Otherwise, student attendance at assigned clinic sessions is required, and any violation of the attendance policy results in a reduction of the Family Dentistry course grades.
Variations in the number of individual total days in the clinic resulted primarily from student absences and/or patient cancellations and failures.

Students generally recognize that they can work more efficiently in a four-handed setting than in a solo, unassisted mode; thus, most realize that it is to their advantage not to use the personal days during their assignment to the DAU Clinic. However, some students spent fewer days treating patients in the DAU Clinic due to factors such as personal emergencies, interview scheduling conflicts, and/or poor planning. Whenever a student is absent from an assignment to the DAU Clinic, that student’s operatory and dental assistant are available to students assigned to the “regular” Family Dentistry Clinic. So, some students spent more days treating patients in the DAU Clinic because they took advantage of these additional opportunities.

Each student’s daily clinical productivity (number of patient visits, fees charged) was divided by the actual number of days spent treating patients to compute that student’s individual daily average patient visits and daily average fees charged in each clinic. For each student, average daily productivity in the DAU Clinic was compared with that student’s average daily productivity in the Family Dentistry Clinic. The actual arithmetic differential and ratio for individual average per-visit charges were computed for each student. The mean values, ranges, and quartiles for these indices were tabulated for each class and overall for all D4 students 2005–08.

### Results

Table 1 presents descriptive statistics for student activity in the four-handed clinic (DAU) and in the regular unassisted clinic (FAMD) for the three years of this study. D4 students at the University of Iowa College of Dentistry each treated patients an average of 9.00 days (range four to seventeen days) in the DAU Clinic and 113.58 days (range ninety-two to 132 days) in the regular Family Dentistry Clinic. The number of total patient visits for each student averaged 23.47 visits (range seven to thirty-four visits) in the DAU Clinic and 197.61 visits (range 152 to 259 visits) in the regular Family Dentistry Clinic. Table 2 presents descriptive statistics for student revenues. Total fees charged per student averaged $2,946 (range $795 to $8,354) in the DAU Clinic and $21,593 (range $15,099 to $40,889) in the regular Family Dentistry Clinic.

As computed and tabulated in Table 3, students averaged 2.62 patient visits per day (range 1.40 to 3.67 visits) in the DAU Clinic and 1.74 visits per day (range 1.52 to 2.06 visits) in the regular Family Dentistry Clinic. The influence of four-handed delivery on each student’s daily productivity (patient

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<td>Individual Student Total Days in Clinic</td>
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<td>2005–06</td>
<td>73</td>
<td>120.08 ±6.88</td>
<td>9.10 ±1.12</td>
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<td>[100*±132]</td>
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<td>[116,121,125]</td>
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<td>2006–07</td>
<td>75</td>
<td>125.63 ±7.44</td>
<td>9.29 ±2.02</td>
<td>116.33 ±6.83</td>
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<td>2007–08</td>
<td>72</td>
<td>121.92 ±5.63</td>
<td>8.59 ±0.76</td>
<td>113.33 ±5.66</td>
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<td>[108±135]</td>
<td>[6.5±10]</td>
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<td>[109,114,117]</td>
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<td>Overall 2005–08</td>
<td>220</td>
<td>122.57 ±7.07</td>
<td>9.00 ±1.44</td>
<td>113.58 ±6.73</td>
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visits, fees charged) was gauged by the computation of the daily productivity differential (DAU daily average minus FAMD daily average) and the daily productivity ratio (DAU daily average divided by FAMD daily average) for each student. With regard to individual daily average patient visits, the mean daily differential was 0.88 patient visits (range -0.36 to 1.97), and the mean daily ratio was 1.51 (range 0.80 to 2.16). In other words, students averaged 51 percent more patient visits (range 20 percent fewer visits to 116 percent more visits) daily in the DAU Clinic as compared to the regular Family Dentistry Clinic.

As illustrated in Table 4, the mean daily charges for services provided by individual students averaged $329 (range $148 to $928) in the DAU Clinic and $190 (range $140 to $312) in the regular Family Dentistry Clinic. With regard to individual daily average fees charged, the mean daily differential was $139 (range -$74 to $763), and the mean daily ratio was 1.75 (range 0.70 to 5.62). In other words, students averaged 75 percent higher charges (range 30 percent lower charges to 462 percent higher charges) daily in the DAU Clinic as compared to the regular Family Dentistry Clinic.
Data regarding the individual average charges per patient visit are presented in Table 5. The mean per-visit charges for services provided by individual students averaged $127 (range $55 to $278) in the DAU Clinic and $109 (range $79 to $182) in the regular Family Dentistry Clinic. The mean per-visit differential was $18 (range -$60 to $186), and the mean daily ratio was 1.17 (range 0.50 to 3.00). In other words, students averaged 17 percent higher charges per patient visit (range 50 percent less per visit to 200 percent more per visit) in the DAU Clinic as compared to the regular Family Dentistry Clinic.

Discussion

Although the results of this study generally demonstrated that most students were more productive practicing four-handed than practicing solo, some notable variations in the data, from student to student and from year to year, were observed.
It is interesting to observe that there were students in each class who were actually less productive in the DAU Clinic than in the regular Family Dentistry Clinic, as evidenced by a negative value for the mean daily differential of fees charged and/or a mean daily fee charged ratio of less than one. Although the values (Table 4) for the mean daily differential of fees charged ranged from -$74 to $763, it is important to note that the first and third quartile values overall for the three years of this study were $64 and $194, respectively. Thus, 50 percent of the students had individual average daily production in the DAU Clinic that was in the range of $64 to $194 higher than their individual average daily production in the regular Family Dentistry Clinic. Likewise, although the values for mean daily fee ratio ranged from 0.70 to 5.62, the quartile values reveal that 50 percent of the students had average daily fees that were in the range of 31 percent to 100 percent higher in the DAU Clinic than in the regular Family Dentistry Clinic.

Fees charged by student practitioners for procedures in our predoctoral clinics are approximately 50 percent of the prevailing private practice fees for these procedures in our local area. The overall (DAU and FAMD) individual daily average fees charged per student increased by roughly 3.5 percent each year; this was consistent with the annual increases in our clinic fees per procedure.

The mean number of patient visits per student in the DAU Clinic showed a trend of decreasing from year to year in this study (25.25 in 2005–06, 23.32 in 2006–07, 21.83 in 2007–08). A likely explanation for this phenomenon is that shorter patient visits were encouraged in the first year (2005–06) after the reorganization of the DAU Program, but this emphasis was reduced somewhat in subsequent years. This is consistent with a coincident reduction in the individual average visits per day in the DAU Clinic after the first year (2.79 visits per day in 2005–06, 2.53 in 2006–07, 2.54 in 2007–08) and a coincident increase in the average charge per visit in the DAU Clinic over the years ($108 per visit in 2005–06, $132 in 2006–07, $140 in 2007–08).

It is generally accepted that predoctoral clinics are not profitable operations for dental schools. It is generally accepted that predoctoral clinics are not profitable operations for dental schools. In that same Macy Study report, Bailit et al. argued that, in the current environment of shrinking government support for dental schools, the potential for patient care revenue to contribute more to overall revenues should be re-examined. Bailit suggested that senior dental students working with a dental assistant in patient-centered dental school clinics could be expected to generate clinic revenues averaging $40 per hour.

During the three years observed in our study, our students’ revenues confirmed Bailit’s contention; in fact, students in our DAU program averaged a daily (six hours) individual clinical productivity of $329 (range $148 to $928), which would translate to $55 per hour (range $25 to $155). During this period, we found that our D4 students produced roughly 75 percent more clinic revenue when operating in the four-handed DAU Clinic, as compared to the same students’ clinical productivity in the regular (solo, unassisted) Family Dentistry Clinic.

One might deduce that further expansion of the DAU program would have the potential for turning our predoctoral student clinics into profit centers for the College of Dentistry. However, several other realities must be considered.

A new entry-level dental assistant in our university system will currently start at an annual salary of $28,647, with the fringe benefits package costing the department an additional $13,894. Thus, the annual salary/benefits cost to add a single full-time dental assistant in our predoctoral clinics is approximately $42,451. These employees earn eleven paid holidays and twenty-four days of vacation/personal leave per year, leaving approximately 226 working days per year. Thus, the daily salary/benefits cost for each additional dental assistant is approximately $188 ($42,451÷226). This would be only partially offset by a projected $159 (2007–08 mean daily productivity differential, Table 4) daily increase in clinical revenues. And although the salary/benefits cost for the dental assistant is by far the major extra expense incurred in providing the DAU experience for our D4 students, there are other additional costs of operating the program (facilities costs for upgraded clinical area, faculty costs for decreased student-to-faculty ratio), which must be considered as well. As noted earlier in this article, the fees charged by student practitioners for procedures in our predoctoral clinics are approximately 50 percent of the prevailing private practice fees for these procedures in our local area. Dental schools with higher or lower fees and/or different overhead structures may find a predoctoral DAU program to be more or less profitable.
But even if a DAU program does not prove to be a significant revenue stream for dental schools, the critical educational value of such a program still must be acknowledged. As the CODA accreditation standards stipulate, dental schools are expected to develop and implement practices, operations, and evaluation methods so that teamwork and cost-effective use of well-trained allied dental personnel are emphasized. The competent ergonomic practice of four-handed dentistry can lead to stress reduction, increased productivity, improved efficiency, and increased profit for our graduates.

Summary and Conclusions

The results of this study demonstrate that fourth-year dental students were approximately 75 percent more productive operating with a trained dental assistant than they were operating alone. Although the increased revenues might not be sufficient to offset increased expenses incurred in operating the four-handed clinical operation, the understanding and practice of the principles of four-handed dentistry are essential components of a predoctoral dental education.

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REFERENCES