Critical Issues in Dental Education

The Arizona Model: A New Paradigm for Dental Schools


Abstract: The traditional method for the delivery of didactic instruction and patient care in dental schools has come under fire from a number of sources over the past several years. The American Dental Education Association and others have outlined numerous issues impeding the swift progression of student learning through the dental curriculum. Declining state revenues allotted to dental education, the increasing shortage of dental faculty, and the management of student learning in an already overcrowded dental school curriculum have led to the investigation of strategies that address solutions to these and other shortcomings in the current milieu of dental education. To address these deficiencies, strategies for change have been suggested. This article describes the development, implementation, and assessment of a new dental school that addresses these and other challenges to the education of today’s dental student, thus creating the Arizona Model. Following seven years of operation, outcomes analysis at the Arizona School of Dentistry & Oral Health has shown positive trends in controlling educational costs, a shift to a modular curriculum, increasing student clinical experiences, and, consistent with the mission of the school, producing dentists who are well prepared for dental public health service.

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In today’s economy, dental schools are under increasing pressure from parent universities and health science centers to cut costs and increase revenues. The complex predoctoral dental curriculum, already overcrowded, has become more unwieldy and difficult to manage in recent years. Integration of basic, dental, and clinical sciences, effective delivery of preclinical instruction, and increased pressure to incorporate newer dental technologies into the curriculum has made this task even more difficult for dental school administrators. A 1996 article by an FDI World Dental Federation working group on flexibility in the dental curriculum notes: “Basic science should become more and more horizontally integrated, probably through the establishment of oral biology departments where all basic areas in relation with dentistry could integrate their knowledge and make it relevant.”

Providing diverse and comprehensive clinical experiences for students is also a major concern for dental school administrators, in addition to maintaining clinic revenue. Data from the American Dental Association survey of dental education emphasize the difficulty of this task in that dental school clinics are inherently inefficient financially, creating a significant negative gap between revenue and expenses. External community clinical site rotations provide students with diverse patient experiences, and it would seem, at first glance, that this would decrease the net income for the school clinic. However, Bailit in his 2008 study notes that just the opposite is true: when senior students provide up to 70 percent of clinical care in offsite community clinics, the percentage of net savings to the school was calculated to be 8.1 percent. Thus, the difficult task of increasing clinic income is one area of the dental school budget that may provide the greatest flexibility for change.

Foundational to increasing clinic revenue is increasing the productivity and proficiency of the predoctoral dental student. This requires adjustments to the curriculum, the facilities, the workforce, and/or other factors that dictate the progression of both students and their patients through the dental school clinic system. Unrelated to the financial consider-
ations is the need to provide today’s student with a more robust and diverse clinical experience. Baum asserts that there will be an increasing need for dentists to deal with a growing number of medically complex and compromised patients due to the aging U.S. population, as well as the advances in medical technology that will allow more seriously ill patients to be treated in mainstream clinical environments. Additionally, the United States is experiencing significant growth in the underrepresented, underserved, and multicultural patient populations. To ignore the needs of these populations because the dental education system in the United States has not adequately prepared future dentists to meet their unique needs is unconscionable and a disservice to communities where these populations reside. In a study that measured the attitudes of dental school graduates, DeCastro et al. found that senior students who spent more time in community-based clinics were significantly more supportive of community-based learning and more confident in their clinical skills when compared to graduates of traditional programs.

More than a decade and a half ago the Institute of Medicine and more recently the Macy Study argued that, for dental schools to survive financially and continue to educate dentists prepared to address the demands of twenty-first century dentistry, curriculum reform must occur, particularly with regard to basic science and clinical education. Dental schools must adapt to a rapidly changing educational marketplace and population needs or risk the possibility of closure.

A major factor in the paradigm shift of dental education reform is the economics of educating students to become dentists. Undergraduate and postgraduate educational costs continue to drastically increase, and professional graduate programs like dentistry are not immune to this trend. For predoctoral dental programs, the average (private and public) first-year in-state resident tuition reported for 2008–09 was $27,961. In 1993, the average in-state tuition and fees for four years of dental school was $39,786; this amount increased to $65,520 (64.7 percent) in 2002 and to $110,084 (59.5 percent) in 2008–09. Consequently, as student debt burdens grow heavier and average incomes for dentists in private practice increase, a mere 0.8 percent of recent graduates choose teaching, research, or administration as career tracks, largely because they are not financially lucrative.

The single largest line item in today’s dental school budget is faculty compensation and benefits. Delivery of basic science instruction, especially in schools not affiliated with schools of medicine, requires a significant investment in faculty members who have relatively few student contact hours compared to clinical faculty members. Additionally, the number of basic science faculty members available to fill vacant basic science positions decreased by 35 percent between 1992 and 2002. An American Dental Education Association report on vacant budgeted faculty positions noted that, in 2007–08, there were 369 vacant budgeted faculty positions and that 76 percent of these were in the clinical sciences. With the number of dentists per capita declining, few graduates choosing academics as a career path, 55 percent of full-time dental school faculties being fifty years of age or older, and the opening of four new dental schools since 2002, there is a nationwide shortage of dental school faculty members. Therefore, solutions to creatively share faculty resources must now be seriously considered.

When plans for the establishment of the first dental school in Arizona were discussed in 2001, these structural and economic factors were taken into consideration. The group charged with the development of the A.T. Still University of Health Sciences Arizona School of Dentistry & Oral Health realized that the traditional dental educational model must respond to the pressures of state legislators, university systems, and accrediting agencies and was compelled to make a radical shift away from the traditional dental school structure toward a new and innovative approach that would serve the needs of all population groups with a specific emphasis on underserved and underrepresented populations while remaining financially viable. This article describes the concept, development, and structure of this innovative approach, referred to as “the Arizona Model.”

Development of the Arizona Model

A.T. Still University of Health Sciences (ATSU) is the parent university for the founding college of osteopathic medicine in the United States, the Kirksville College of Osteopathic Medicine located in Kirksville, Missouri. ATSU established a formal presence in Arizona with the formation of the Arizona School of Health Sciences (ASHS) in 1995, granting graduate degrees in physician assistant studies, physical therapy, occupational therapy, human movement, athletic training, audiology, and health
sciences. In the past eleven years, the Arizona School of Dentistry & Oral Health (ASDOH), the School of Health Management, and the School of Osteopathic Medicine Arizona have been added to the university.

In the late 1990s, representatives of the U.S. Indian Health Service, existing partners of ASHS, requested that the university establish a dental school. Initially, university leaders dismissed the concept due to the expense of operating a traditional dental school. However, after continued community requests, a feasibility study was undertaken. The university’s existing relationship with the National Association of Community Health Centers helped to identify extensive community-based clinical education as a key component of the Arizona Model.

Convinced that the establishment of a dental school in Arizona was a worthy pursuit, the university assembled a group of experienced and distinguished dental school administrators and faculty from around the country for discussion and planning. The group was charged to think creatively and to propose forward-thinking ideas that would address escalating tuition costs, faculty shortages, cost-effective basic science curriculum delivery, enhanced integration of the basic and dental sciences, and increasing the numbers and diversity of clinical experiences. More importantly, however, university administration was clear in its directive that the overarching framework or mission of the model must emphasize service to the underserved through community service and public health.

Mission

Central to the development of the Arizona Model is a carefully crafted mission statement that focuses on service, community, and public health needs while maintaining a strong emphasis on quality and critical inquiry. The mission statement set the framework for the design of the educational structure and serves to guide and inform the administration in making major decisions. It reads as follows:

The mission of the Arizona School of Dentistry & Oral Health is to educate caring, technologically adept dentists who become community and educational leaders, serving those in need, and:

- To be the leader in the lifelong education of community-responsive general dentists;
- To prepare graduates with a strong foundation of critical inquiry, evidence-based practice, research, cultural competence, an orientation to prevention, and interdisciplinary health care experiences; and
- To promote the delivery of optimal patient care and the transfer of newly acquired knowledge, skills, and technology to the profession and to the community.

Additionally, the development group formulated a set of guiding principles to keep the creation of the model on the intended track (Table 1).

Administration

The ASDOH administrative structure was purposely designed in a horizontal rather than vertical orientation, utilizing fewer full-time faculty members and administrators than can be found in a traditional model. ASDOH administrators serve in multiple roles and often share administrative responsibilities. At ASDOH, there are no departments as would be typical in most dental schools. Disciplines are led by directors or co-directors, utilizing mostly part-time adjunct faculty members to manage the bulk of the teaching duties. Further, the ASDOH Curriculum Committee is made up of a cross section of administrators and faculty members and uses a top-down approach to curriculum management. This approach minimizes discipline-specific curriculum ownership issues.

Admissions

To increase the likelihood that its graduates choose a mode of dental practice that includes a form of service, the admissions process was purposefully structured to enroll students who would be attracted to the ASDOH mission and thrive in the community service-oriented curriculum. In many respects, the ASDOH admissions requirements are on par with other dental schools with regard to prerequisite coursework, minimum entry grade point average (GPA)/Science GPA and Dental Admission Test (DAT) scores. However, unlike most dental schools, applicants must demonstrate a considerable amount of community service to be considered for an interview. The administration realized that it is not difficult to teach otherwise intelligent people to become dentists; however, it is difficult to instill a heart for serving the needs of others. Identifying that heart for service is critical in the admissions process. Thus, for the first seven classes (2007 through 2013), the average number of community service hours ranged
from 500 to 691 hours, with individual hours ranging from 100 to over 2,000.

For the first seven classes of ATSU dental students (2007 through 2013), the mean age of students at the time of matriculation was twenty-five to twenty-eight years, with a range of sixteen to forty-seven years. Demographically, students were nearly equally divided between men and women. In an attempt to address the needs of historically underserved populations, specific recruitment of underrepresented minority (URM) groups in health professions is a priority at ATSU and within the dental school specifically. Thirteen to 15 percent of each of the first seven classes of students were URM students, with a total of fifty-eight URM students. Of the ASDOH URM students in the first seven classes, 50 percent identified as Hispanic/Latino, 50 percent as American Indian, and 14 percent as black (Figure 1).

For the first seven classes of ASDOH students, the range of means for undergraduate GPAs was 3.32 to 3.59 on a four-point scale, with the range for individual students being 2.62 to 4.0. By class, the range of means for science GPAs was 3.16 and 3.54, with the range for individual students being 2.5 to 4.0. The mean DAT scores for the classes ranged from 16.94 to 18.72, with the range for individuals being 13 to 25.

### Structure of the Curriculum

The ASDOH Doctor of Dental Medicine (D.M.D.) curriculum spans four full-time academic years (eight semesters scheduled over four twelve-month academic years) utilizing a combined biological, psychological, and social approach to foster an integration of basic/human, behavioral, and clinical sciences (Table 2). The first-year curriculum is unique in the method of delivery of the basic integrated human sciences, in that rather than a typical approach of separate courses for anatomy, biochemistry, physiology, and the other core basic science courses, the first-year content is presented in a systems review format using a modular delivery. For example, the endocrinology module is taught in a one-week period by a nationally known educator in endocrinology, wherein all aspects of the basic science disciplines related to the endocrine systems are incorporated into the instruction, followed by another one- to three-week module reviewing another body system such as hematology, musculoskeletal, neuroscience, etc. To retain continuity and communication, all faculty members are contracted to remain available to ASDOH students for one year following their module/course. Faculty members are also required to attend an annual two-day faculty retreat to coordinate content integration across modules.

### Table 1. ATSU ASDOH guiding principles

1. Integration: Basic science, clinical, public health, dental business, and all other curricular content are to be integrated to the fullest extent possible.
2. Laboratory: The amount of time students spend doing laboratory procedures is to be minimized.
3. Basic Science Faculty: No full-time basic science faculty members are to be hired, and all of the basic sciences are to be taught in a modular format utilizing visiting faculty members.
4. Preclinical Faculty: The number of full-time preclinical dental science faculty members is to be limited; instead, the majority of the preclinical instruction is to be by part-time adjunct faculty members.
5. Curriculum Management: The curriculum is to be managed centrally utilizing a “top-down” approach directed by the Curriculum Committee.
6. Departments: The dental school is to be organized by discipline-specific areas overseen by specialty directors or co-directors and not by a departmental structure.
7. Clinical Curriculum: The clinical curriculum is to maximize the use of external community sites and is to be a two-year curriculum that does not require a student to “graduate” from the third year in order to promote to the fourth year.
8. Tenure: A tenure system is not to be utilized, but rather one- to two-year renewable contracts are to be in place.
9. Collegiality: Students are to be treated in a collegial manner—one of a developing colleague.
10. Dentist of the Future: The emphasis is to be on educating dentists for the 21st century, including equipping dentists to manage the care of patients with complex needs in an ever-changing health care environment and to address health needs of communities and underserved populations.
Table 2. ASDOH four-year predoctoral dental curriculum focus areas

<table>
<thead>
<tr>
<th></th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Integrated Human Science</td>
<td>• Operative Dentistry II</td>
<td>• Clinical Dentistry: 32 hours a week in on-campus dental clinic</td>
<td>• Clinical Dentistry: 40 hours a week, 50% on-campus dental clinic and 50% off-campus external clinical rotation sites</td>
</tr>
<tr>
<td></td>
<td>• Introduction to Dentistry</td>
<td>• Dental Sciences</td>
<td>• Clinical Dentistry Seminars</td>
<td>• Dental Business II</td>
</tr>
<tr>
<td></td>
<td>• Dental Anatomy</td>
<td>• Clinic Orientation II</td>
<td>• Orthodontics</td>
<td>• 3 seminar weeks (on-campus)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Public Health</td>
<td>• Oral Pathology II</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Community Dentistry</td>
<td>• Dental Business I</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clinical Dentistry Seminars including student treatment planning seminars</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Clinic Orientation II: general dentistry and internal specialty rotations</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Public Health</td>
<td>• Community Dentistry</td>
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<tr>
<td></td>
<td></td>
<td>• Community Dentistry</td>
<td>• Behavioral Sciences</td>
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</table>

First Semester
- Anatomy & Physiology of Head & Neck
- Etiologies & Pathologies of Oral Diseases
- Operative Dentistry I
- Clinic Orientation I
- Dental Auxiliary Utilization

Second Semester
- Anatomy & Physiology of Head & Neck
- Etiologies & Pathologies of Oral Diseases
- Operative Dentistry I
- Clinic Orientation I
- Dental Auxiliary Utilization

Figure 1. ASDOH URM dental students
The second half of the first year and the second-year curriculum build on the knowledge base of the biomedical sciences and shift the focus from systems and tissues to the dental sciences. Simulated clinical experiences are extensive during this time, covering all of the major clinical disciplines as well as behavioral sciences. Additionally, students begin required public health coursework, which includes five master’s degree level courses offered online by the ATSU School of Health Management. This coursework culminates in a Certificate in Public Health Core Concepts (a graduation requirement), with students given the option of completing a Master’s in Public Health (M.P.H.) degree. At this point in the curriculum, students begin a year-long clinical orientation module to prepare them for patient care, as well as a three-year course of study on the role of dentistry in the community, designed to provide specific skills and experiences to meet the needs of various population groups.

In addition to the required curricular content that includes evidence-based dentistry and principles of research, students can opt to participate in research clerkships. Clerkships typically occur between either the second and third years and/or the third and fourth years. Clerkships last six weeks and occur either at ATSU or at one of the twenty-four other research clerkship sites established around the country. Students have opportunities to present their work at the annual ASDOH Research Day, as well as at other local, national, and international meetings. In the first three cohorts of students, eight, twelve, and twenty students respectively have participated in research clerkships in biomedical sciences, restorative sciences, and public health.

The third year is primarily focused on the delivery of dental care at the university-based on-site dental clinic in Mesa, Arizona. Students spend thirty-two to thirty-six hours per week delivering patient care and are paired into mentoring teams that include second-, third-, and fourth-year students, which manage the care of their collective families of patients. When a student is away on an external rotation, the other team members assume that student’s patient care.

Teams are assigned to one of four faculty group leaders called Comprehensive Care Unit Directors. Internal clinical rotations that include the specialty disciplines occur during the third and fourth years and include oral surgery, provisional diagnosis and emergency care, pediatric dentistry, and radiology. Didactic coursework during the third year targets four specific areas: clinical dentistry (including dental business), treatment planning, evidence-based dentistry, and community dentistry.

The focus of the fourth year continues with students honing their clinical skills, spending approximately 50 percent of their time at the on-site clinic and 50 percent in four to five external rotation site clinics. The external sites, of which there are approximately sixty in twenty-five states including Arizona, are selected for their ability to provide students with a robust and diverse clinical environment. Sites include community health centers, Indian Health Service/tribal clinics, Veterans Affairs clinics, and other nonprofit clinical programs. Notably, although the majority of fixed prosthodontics, scaling and root planing, and endodontic procedures completed by students in the first three graduating classes were completed in the eighty-four-chair on-site clinic, the majority of amalgam and composite restorations and extractions were completed in the community-based external rotation site clinics (Figure 2). The percentage disparity between the on-site and off-site clinics seen with fixed prosthodontics, scaling and root planing, and endodontics can best be explained by the heavy reliance on emergency and restorative care that is indicative of many community-based clinical sites and was accounted for in the planning of the comprehensive clinical education program.

Faculty members supervising students at the external rotation sites are credentialed as adjunct faculty. In all but one of their fourth-year clinical rotation sites, external faculty members are trained and standardized to evaluate student performance as are the on-site clinic faculty, using the same clinical assessments. The other rotation is usually a less structured experience in which a student is either at a site that is of particular interest to the student or where the student is able to pursue individual clinical interests. Both internal and external clinical faculty members receive initial and at least annual clinical faculty standardization, calibration, and training. A research project is currently under way to measure the degree of reliability between faculty members in their preclinical and clinical assessment of student performance.

Incorporation of Current Technology

Henzi et al. surveyed dental students’ opinions of the dental curriculum and identified opportunities for improvement. One student surveyed noted:
“I think the school should place an emphasis on newer and more modern techniques and applications. . . . We are taught a good basis of material, but when we graduate, we could end up being old-fashioned in regards to techniques.”

Examples of ASDOH’s commitment to utilizing the latest in technology include a majority of student participation in the placement and restoration of at least two implants and the requirement for laser certification, as students have access to multiple laser systems in the clinic. ASDOH students are also exposed to a wide array of newer dental technologies including digital radiography, Cone Beam 3D imaging, digital impression systems, and CAD/CAM restorative techniques. Currently, the ASDOH on-site clinic is converting to a comprehensive web-based clinic management system, which will be the first of its kind in dental education. This system will provide not only a complete electronic patient record but also a method for online assessment.

ASDOH considers itself an early adopter of the newest technologies; therefore, instruction in evidence-based practice is critical for students and faculty members. Ultimately, the school’s commitment to staying current with developing dental technology is a major benefit for both students and the faculty.

Advantages and Challenges of the Arizona Model

There are several advantages to the Arizona Model; however, the single most important advantage is the impact on the budget. Across the nation, dental school deans are spending more time in fundraising and development efforts than in years past, due to the escalating costs of dental education, declining state support, and declining revenues.\textsuperscript{13} Utilizing the Arizona Model, the cost savings realized by the university to deliver the basic science curriculum is significant. Specifically, the entire basic science curriculum can be delivered for approximately the salary and benefits of two to three full-time equivalent faculty members. All dental schools will vary as to costs associated with delivery of the basic science curriculum, whether there is an affiliation with a medical school, which could provide faculty jointly, or if the costs for all of the required basic science
faculty members are borne by the dental school. Either way, the budget for the basic science curriculum at ASDOH is modest by comparison. The ASDOH faculty and administration includes 446 individuals comprising ~120 FTEs with 44 percent of the individuals internal to the school and 77 percent who have primary appointments at other universities (Table 3).

Because the basic science curriculum is delivered by visiting faculty members, travel, lodging, food, honoraria, and administrative costs make up the bulk of the expenses. Since there is only one faculty member on campus teaching basic science content at any one time, additional savings are realized in facilities as a single office is provided for all visiting faculty members.

This model also offers great flexibility in curriculum delivery. In traditional models, once the curriculum structure and sequence are put into place, it takes significant effort to make any sort of change. Department chairs, directors, and faculty protective of their respective areas are reluctant to make changes or give up control. The curriculum of the Arizona Model is driven by a faculty-centered curriculum committee that directs structure and sequence through a top-down approach, which allows for maximum flexibility related to content and integration. With no departments and relatively few full-time faculty members, flexibility is enhanced, and curricular changes can be made on an as-needed basis.

Finally, with earlier clinical experiences, increased clinical experiences in the third year, and half of the fourth year spent in external clinical rotation sites, students quickly increase their speed and proficiency. When provided with a good patient treatment mix and access to dental assistants, students easily increase their clinic production. A sample of ASDOH students returning to work in the school's dental clinic following external clinical rotations produced an average of $3,362/month. By comparison, Formicola reported an average student monthly gross clinic revenue of $1,000: this represents a 3.5 times increase in gross clinic production. Additional analyses of clinical production by dental students in both the ASDOH dental clinics and external clinical rotation sites are currently in progress. In addition to improving clinical skills, confidence, and speed, the external clinical experiences help the students to develop skills in interacting with people from diverse cultures and life experiences; give them opportunities to assess various health care delivery systems in which dental care is delivered in different states and communities; and allow them to develop a network of colleagues.

The most serious challenge of the Arizona Model is sustainability, especially in securing the commitment of the visiting faculty. Competing priorities, time away from their home institution, institutional polices that limit outside participation, and increased workload at their home institution all factor into the visiting faculty member's decision to teach/continue to teach at ASDOH. However, it should be noted that the basic science faculty has remained very consistent for over seven years, and innovative contractual relationships have started to develop across dental schools, which could lead to regionalization of faculties.

Another challenge of this model is its lean structure, with the limited number of full-time administrators and faculty members at risk of experiencing burnout due to the heavy workload in managing multiple areas and responsibilities. In time, more advantages and challenges of the Arizona Model will become evident.

**Table 3. ASDOH faculty and administration**

<table>
<thead>
<tr>
<th>Faculty Role</th>
<th>Number of Faculty Members</th>
<th>FTE</th>
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</thead>
<tbody>
<tr>
<td>Administration</td>
<td>7</td>
<td>6.75</td>
</tr>
<tr>
<td>Basic Science</td>
<td>19</td>
<td>0.46</td>
</tr>
<tr>
<td>Preclinic</td>
<td>54</td>
<td>6.97</td>
</tr>
<tr>
<td>Clinic: Internal Clinics</td>
<td>117</td>
<td>78.28</td>
</tr>
<tr>
<td>Clinic: External Clinics</td>
<td>249</td>
<td>27.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>446</strong></td>
<td><strong>119.96</strong></td>
</tr>
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**Outcomes**

Since the first class was enrolled in 2003, the financial model has remained sound even in challenging economic times. There has also been an extremely low turnover of faculty and administrators, and nearly all faculty positions are currently filled. Further, students have performed well on standardized examinations. Nearly 100 percent of all ASDOH graduates (2007–09) have successfully completed the National Board Dental Examination Part I and Part II, as well as the Western Regional Examining Board examination within one year of first attempting these exams (Table 4). Graduates have also been successful in securing postgraduate training opportunities. In the first three graduating classes, 19 percent (2007), 32 percent (2008), and 30 percent (2009) have been
accepted into dental residency/specialty programs with the majority entering pediatric dentistry and postdoctoral general dentistry programs.

Consistent with the school’s mission, 32 percent or more of graduates from the first three classes (2007, 2008, and 2009) who have chosen to enter practice have elected to practice in community-based/public health settings (53 percent, 32 percent, and 32 percent respectively). Additionally, based on the types of students admitted to ASDOH and the educational experiences provided within the program, the overwhelming majority of graduates will likely be involved in a community outreach venture, whether as a full-time or part-time employee in a community clinic, a volunteer in a community service project, or an advocate for public health efforts in their community. Assessing these outcomes will be critical in evaluating the extent to which the school is meeting its mission.

Discussion

Although new, innovative, and cost-effective, early evaluation of the Arizona Model shows promising results. Overall, the ATSU Board of Trustees as well as administrators, faculty, staff, students, and external clinical partners are very pleased with student performance and evolution of the model. Analysis of data from surveys of the 2007–09 graduates has shown positive reactions to experiences both on and off campus.

Historically, dental school clinics have operated as teaching laboratories rather than patient-centered delivery areas in which the faculty practice as they supervise and mentor students and residents. Additionally, it has been shown that dental school clinics can become less of a drain on a school’s resources if students spend a significant amount of time in their senior year at offsite community clinics. Financial sustainability for dental schools will require operational designs that ensure that dental school clinics are at best revenue generators and at worse revenue neutral. The Arizona Model is designed to be cost-efficient with a curriculum design that minimizes the number of faculty members needed for content delivery, creates a horizontally lean administrative structure, provides offsite clinical experiences to maximize student proficiency, and provides a clinical training environment that creates the best opportunity for the clinical program to be revenue-generating.

However, as well as the model has worked thus far, there are multiple aspects in need of improvement. For example, the guiding principles noted previously called for “no basic science faculty” members to be hired on a full-time basis but, over time, it has become apparent that a minimum of one basic scientist to serve as a standing member of the curriculum committee would be an ideal addition to this model. This faculty member would also coordinate teaching and learning and the facilitation of integrated cases in the basic sciences. In lieu of such a position, a current faculty member recently assumed this role and is working on a comprehensive assessment of areas for further integration with the basic science curriculum as well as integration within the dental sciences. This faculty member is also responsible for soliciting and promoting the incorporation of the latest biomedical sciences technologies into the curriculum by visiting and internal faculty members, specifically as related to the first-year curriculum. It should be noted that many of the basic science faculty members have reported a dedication to curriculum enhancements, refinements, and integration in the predoctoral dental

Table 4. ASDOH student performance on standardized examinations, as of March 5, 2010

<table>
<thead>
<tr>
<th>Examination</th>
<th>2007 (n=53)</th>
<th>2008 (n=54)</th>
<th>2009 (n=54)</th>
<th>2010 (n=55)</th>
<th>2011 (n=59)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBDE Part I (first attempt)</td>
<td>71%</td>
<td>91%</td>
<td>93%</td>
<td>94%</td>
<td>92%</td>
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<tr>
<td>NBDE Part I (one year pass)</td>
<td>100%</td>
<td>100%</td>
<td>98%</td>
<td>100%</td>
<td>98%</td>
</tr>
<tr>
<td>NBDE Part II (first attempt)</td>
<td>91%</td>
<td>100%</td>
<td>89%</td>
<td>Not yet available</td>
<td>Not yet available</td>
</tr>
<tr>
<td>NBDE Part II (one year pass)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>Not yet available</td>
<td>Not yet available</td>
</tr>
<tr>
<td>WREB (first attempt)</td>
<td>94%</td>
<td>96%</td>
<td>83%</td>
<td>Not yet available</td>
<td>Not yet available</td>
</tr>
<tr>
<td>WREB (one year pass)</td>
<td>100%</td>
<td>100%</td>
<td>98%</td>
<td>Not yet available</td>
<td>Not yet available</td>
</tr>
</tbody>
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NBDE: National Board Dental Examination
WREB: Western Regional Examining Board exam
curriculum at levels that they have not experienced at their home institutions.

The traditional lecture method of instruction has proven challenging for both faculty members and students as they spend up to eight hours per day concentrating on one particular topic area in the modular curriculum format. The modular curriculum has been a catalyst for adoption and implementation of other instructional methods including cooperative learning, case studies, expert panels, and small-group discussions. Additionally, plans are currently being considered for incorporation of audiovisual content and self-paced, interactive web-based instruction into the basic science and preclinical curricula. Finally, changes to the fourth-year extern clinical rotations have already been implemented including the timing, financing, and duration of the experiences.

Although there are currently ten faculty research projects in progress at ASDOH, additional investment and commitment to educational research are other areas for consideration. This innovative approach to dental education provides fertile ground for research in the areas of clinical education, faculty standardization, effectiveness of the admissions process, impact on the profession, changes in the practice of dentistry, and much more. Further investment and collaborations are important to ensure research is conducted on this and other new models of dental education.

Conclusions

Is the Arizona model the answer to calls for reform in dental education? This model does show promise. The traditional dental school model has come under increasing scrutiny, and with the many challenges facing dental education as a whole, perhaps the time has come to approach dental education from a different perspective.

We recognize that ASDOH benefitted from the unique opportunity to create a dental school without the constraints of a long-standing institutional culture. The model shows evidence of containing costs; positive student performance on external measures of student learning; the ability to increase the amount of clinical experiences in a four-year dental curriculum; and yielding graduates who initially demonstrate a propensity to practice in nontraditional settings.

Long-term evaluation of the model is necessary to measure outcomes regarding the sustainability of the model as well as its impact on the practice of dentistry. Could the principles of this model be incorporated into a more traditional dental school model? Time will tell as administrators from traditional dental education programs around the United States and internationally seek out detailed information on the model and guidance from ATSU and ASDOH administration on modifying their programs in accordance with the principles of the Arizona Model.

REFERENCES