Curriculum Change in Dental Education, 2003–09

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Abstract: This 2009 study of dental school curricula follows a similar one conducted in 2002–03. Through a web-based survey, the authors gathered information from dental schools about 1) past trends in curricular change over seven years; 2) current changes under way in dental school curricula; 3) significant challenges to curricular innovation; and 4) projected future trends in curricular change and innovation. Fifty-five schools (fifty U.S. and five Canadian) responded to the survey for a response rate of 86 percent. In addition to background information, the survey requested information in four broad areas: curriculum format, curriculum assessment, curriculum innovation, and resources needed for curriculum enhancement. Forty-nine percent of the respondents defined their curriculum format as primarily organized by disciplines. Half of the respondents reported the use of problem-based and case-reinforced learning for a section or specific component of some courses. In a significant change from the 2002–03 study, a high proportion (91 percent) of the responding schools require community-based patient care by all students, with just over half requiring five or more weeks of such experience. Competency-based education to prepare an entry-level general dentist seems well established as the norm in responding dental schools. Forty-three percent or less of the responding schools indicated that their students participate with other health professions education programs for various portions of their educational experience. Since the 2002–03 survey, dental schools have been active in conducting comprehensive curriculum reviews; 65 percent indicated that their most recent comprehensive curriculum review is currently under way or was conducted within the past two years. Respondents indicated that the primary reasons for the configuration of the current curriculum were "perceived success" (it works), "compatibility with faculty preferences," "faculty comfort," and "capacity/feasibility." Key catalysts for curricular change were "findings of a curriculum review we conducted ourselves," students' feedback about curriculum, and administration and faculty dissatisfaction. There was an increase in the percentage of schools with interdisciplinary courses, especially in the basic sciences since 2002–03, but no change in the use of problem-based and case-reinforced learning in dental curricula. Respondents reported that priorities for future curriculum modification included creating interdisciplinary curricula that are organized around themes, blending the basic and clinical sciences, provision of some elements of core curricula in an online format, developing new techniques for assessing competency, and increasing collaborations with other health professions schools. Respondents identified training for new faculty members in teaching skills, curriculum design, and assessment methods as the most critical need to support future innovation.

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Since 2005, the American Dental Education Association (ADEA) has made change and innovation in dental education one of the Association's major initiatives. The primary conduit for this initiative has been the ADEA Commission on Change and Innovation in Dental Education (ADEA CCI). The ADEA CCI states its purpose as "to build consensus among all stakeholders in dental education, research, and practice by providing leadership to a systemic, collaborative, and continuous process of innovative change in the education of general dentists so that they enter the profession competent to meet the oral health needs of the twenty-first century and to function as important members of an efficient and effective health care team."[1] Recognizing that each academic dental institution is unique, ADEA CCI has

taken a deliberate role as a facilitator of change and innovation by fostering ideas, providing information, and convening forums for dialogue and learning. Among its accomplishments, the Association through the ADEA CCI has published a series of white papers to assist schools as they develop innovative curricula[2]; written, with extensive input from communities of interest, a set of competencies describing the new general dentist[3]; initiated a liaisons program, currently with 185 representatives from fifty-six dental schools, as a learning community to share new pedagogies, assessment methodologies, and strategies for change; and increased general awareness of curricular challenges facing dental education.[1,2,4]

In the spring of 2009, ADEA in collaboration with the Academy for Academic Leadership (AAL) conducted the Dental School Curriculum Format and Innovations Survey. The survey was based on a comprehensive study of dental school curricula in 2002–03 conducted by a subset of the authors and supported by ADEA and the Fund for the Improvement of Post-Secondary Education.[5] With reference to eleven dental education reform items recommended frequently in the literature, the authors of the 2002–03 study sought to ascertain the extent to which North American dental schools responded to calls for these reforms by making changes to their curricula.[5,6] The authors concluded that respondents were making progress toward implementing many of the recommendations for change proposed in the literature, although few schools had implemented three of the primary reform recommendations: interdisciplinary, thematically organized curricula with focus on disease pathophysiology, problem-centered learning, and community-based patient care experiences.

Using the 2004 report as a benchmark, the purposes of the 2009 survey were to 1) identify trends in curricular change over the past seven years; 2) describe current changes under way in dental school curricula; 3) delineate significant challenges to curricular innovation; and 4) project future trends in curricular change and innovation. In reporting the outcomes of this survey, we will also provide observations about ADEA CCI's influence on change in dental school curricula.

Methods

We utilized a twenty-five-item survey about the format and characteristics of the dental school curriculum at North American dental schools to collect the data summarized in this report. The survey was based largely on the 2002 instrument, but included additional questions to ascertain the extent to which various aspects of the ADEA CCI's efforts have been influential in changing curricula. Several questions related to issues in dental education that have arisen since 2002 were also added. The survey was field-tested for format, content, readability, and completion time in January 2009 at three dental schools that agreed to participate in pilot-testing and was revised based on feedback from these reviewers. Two evaluation specialists with extensive background in survey design also reviewed the instrument and provided recommendations that were incorporated into the final version. The survey was then uploaded to SurveyMonkey, a commercial service that enables users to create web-based surveys.

E-mail addresses of U.S. and Canadian associate deans for academic affairs were obtained from ADEA. In April 2009, one of the authors (NKH) sent an e-mail request to all the U.S. and Canadian associate deans for academic affairs asking them to complete the survey. The message included a URL to a password-protected site for accessing the survey. The original timeline for response was approximately one month. Three subsequent e-mails were sent to the associate deans for academic affairs in May 2009 with an extension of the deadline for responses. Each new request removed those who had responded previously from the distribution list. The total elapsed timeline from the first invitation to respond to the survey to the closure of responses was approximately two months.

The survey collected the following background information from the respondents: name of school, title or position held by the respondent, and the option to submit one's name. In addition to background information, the survey requested information in four areas:

1) Curriculum format: extent of curriculum integration; organization and exposure to basic science information; desired basic science format; organization of clinical sciences before reaching the clinic and clinical learning experiences; use of problem-based learning (PBL) and case-reinforced learning (CRL); community-based clinical learning experiences; extent of interprofessional coursework; actions taken related to the 2008 ADEA Competencies for the New General Dentist; reasons for the current format of the curriculum; faculty awareness of competency-based education; and open comments about the format of the respondent's predoctoral curriculum.

2) Curriculum assessment: importance of various data sources for curriculum assessment; characteristics of students' evaluation of the curriculum and teachers; and most recent comprehensive review of the overall predoctoral curriculum.
3) Curriculum innovation: status of implementation of current and anticipated curriculum innovations; and important catalysts for curriculum change.
4) Resources needed for curriculum enhancement: importance of various resources and actions for achieving planned curriculum enhancements; and ways that ADEA can support curriculum innovation at the respondent's school.

The survey used the following definitions to increase the consistency of responses about PBL, CRL, community-based clinical learning, and competency-based education (CBE):

PBL: There are no or very few lectures; students learn by an inquiry method through exploration of patient health care problems in small groups guided by faculty facilitators; students take responsibility for guiding their own learning and for teaching their peers. Faculty members function as "guide on the side" rather than "sage on the stage."

CRL: Students participate in case-based conferences to augment and reinforce lecture-based instruction. In CRL, cases allow students to discuss application of lecture information and to practice using this information to analyze patient problems.

Community-based clinical learning: This form of learning refers to opportunities for dental students to provide patient care in hospital dental clinics, community-based clinics, or private practices, providing, for example, emergency dental services and periodontal, restorative, endodontic, pediatric, or other dental treatments. The term "community-based clinical experience" does not refer to community service activities (in which, for example, dental students go to schools, community centers, or health fairs to provide oral health education or discuss health careers).

CBE: This form of education is structured around these concepts: 1) competencies are derived from practice analysis, 2) the curriculum consists of interdisciplinary modules that address specific competencies, 3) students move through the curriculum at their own rate, and 4) assessment is based on competency exams and performance in an extended internship that approximates a practitioner's work environment.

Some questions of the survey required the selection of one best answer, while others asked respondents to reply to multiple sub-items using a matrix of choices. Most questions included an option to submit comments, so that respondents could elucidate their answers. With the exceptions of providing a name, options to submit comments on survey items, and a concluding question that solicited open comments from respondents about curriculum format or innovation at their school, all survey items required an answer. Statistical analysis produced frequency distributions (descriptive statistics) for each survey item.

Results

Fifty-five schools returned answers to the survey for a response rate of 86 percent. Of those, fifty were U.S. dental schools and five were Canadian dental schools. The survey was sent to the associate dean for academic affairs at each school. Actual respondents were forty-two academic deans, one dean, four executive associate deans, three curriculum directors, two chairs of curriculum committees, and three with other titles.

Curriculum Format

The initial series of questions asked respondents to characterize the organizational structure of their school's curriculum. Forty-nine percent of the respondents defined their curriculum format as primarily organized according to disciplinary boundaries with a few courses taught by interdisciplinary teams (Figure 1). Similarly, 47 percent indicated that their basic science curriculum was primarily discipline-based with a few interdisciplinary components (Figure 2).

Among the strategies for conducting the basic science component of the curriculum, survey responses were divided, with no single strategy reaching close to a majority in responses. The most frequent format was courses conducted independently by departments but with some topic coordination (33 percent), followed by students' first learning structure and function in discipline-based courses followed by exposure to pathophysiology in an organ system format (24 percent). Seventeen percent indicated that their students learned the basic sciences in an interdisciplinary format via organ systems pathophysiology. Fourteen percent said that students experienced a series of independent basic

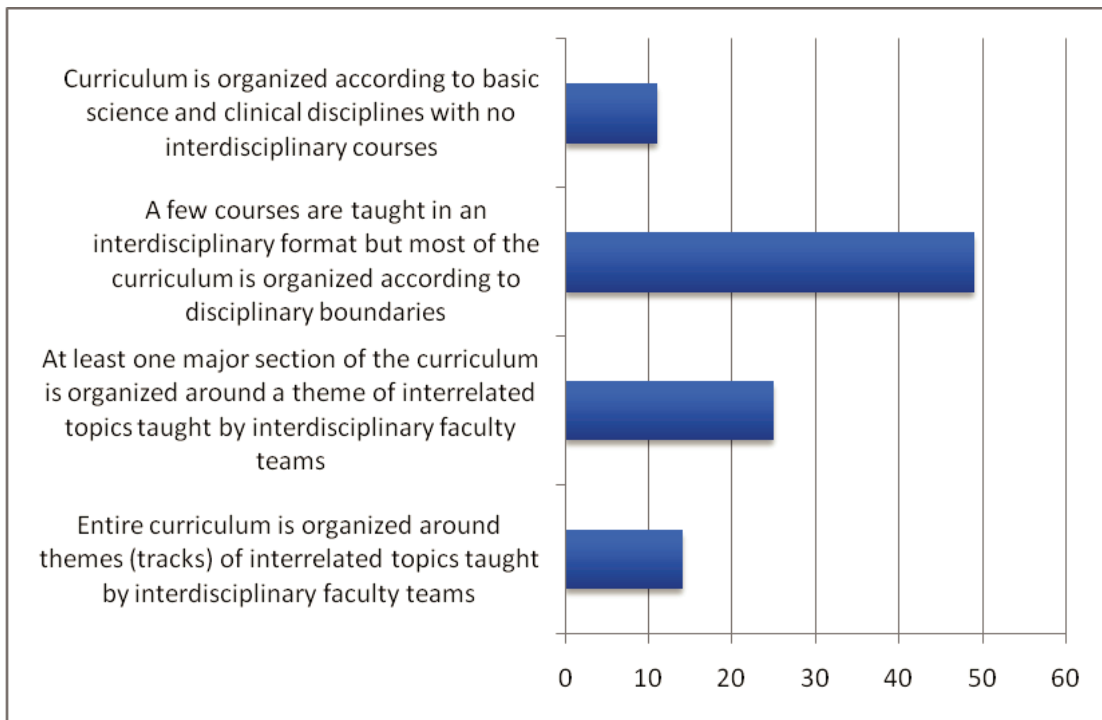

Figure 1. Extent of overall predoctoral curriculum integration, by percent of total responses (N=55 dental schools)

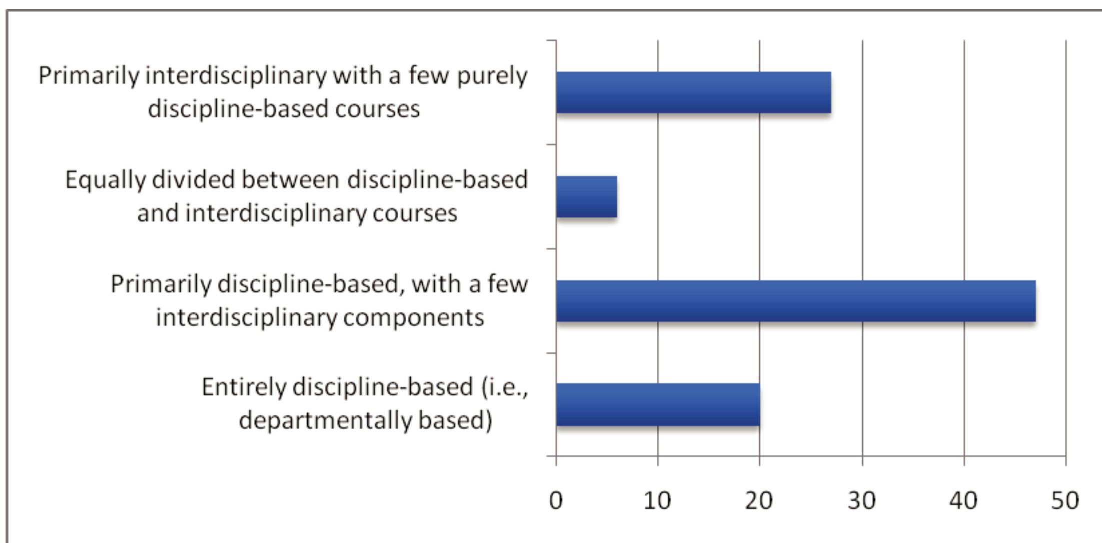

Figure 2. Extent of basic science curriculum integration, by percent of total responses (N=55 dental schools)

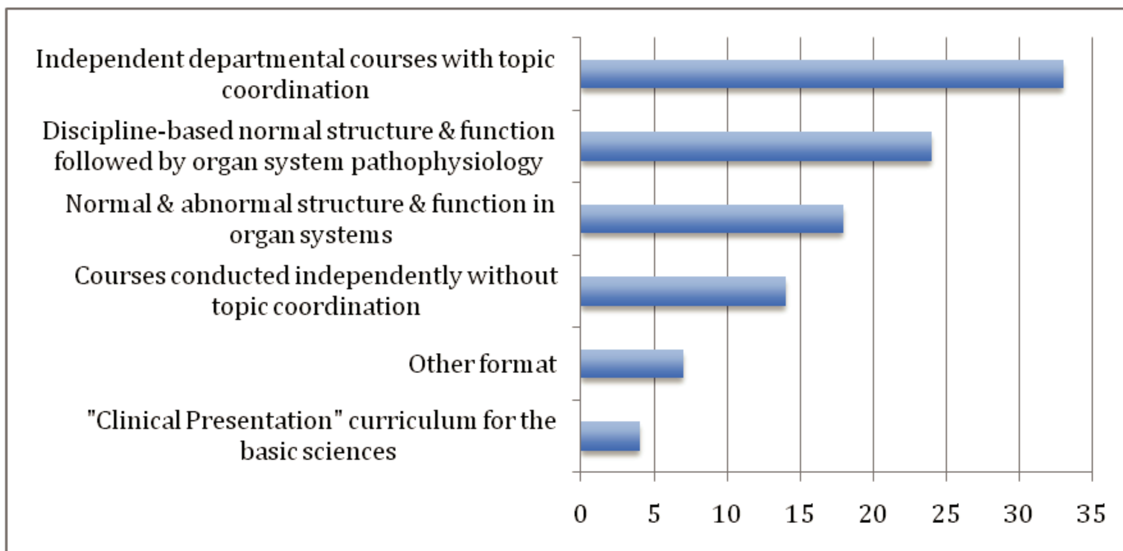

Figure 3. Strategies for conducting basic science curriculum, by percent of total responses (N=55 dental schools)

science courses without topic coordination (Figure 3). In contrast, a majority of respondents indicated that they would most prefer an organ system format for learning the basic sciences (Figure 4).

The majority of schools (53 percent) responded that their clinical sciences curriculum was primarily discipline-based with a few interdisciplinary components (Figure 5). Nonetheless, in just over half of the responding schools, the learning experience in their clinics is based on a general dentistry concept, with competencies in the disciplines being acquired in the context of comprehensive patient care (Figure 6).

Outside of the clinic, 51 percent of the schools reported that they used problem-based learning (PBL) for a section or specific component of some courses, but only 4 percent (two schools) indicated that all of their courses used the PBL format (Figure 7). Similarly, 51 percent of respondents indicated that their schools used case-reinforced learning (CRL) in the curriculum, with 4 percent (two schools) indicating that CRL was used extensively in the entire curriculum outside of the clinic (Figure 8).

A high proportion (91 percent) of the responding schools require community-based patient care by all students, with just over half (51 percent) requiring five or more weeks of such experience. Only one school reported no community-based patient care (Figure 9).

Thirty-five percent of the responding schools indicated that their students participate with other health professions education (HPE) programs for various portions of their educational experience. A notable exception was that 62 percent have joint clinical experiences for dental and dental hygiene students. Less than one-half of responding schools have their dental students providing clinical care in community settings in collaboration with other HPE students (Figure 10).

A majority of schools indicated that they have already taken actions or plan to take actions related to the 2008 Competencies for the New General Dentist published by ADEA in the *Journal of Dental Education* in July 2008 (Table 1).[3] Actions already taken by schools in relation to the new ADEA competencies include alerting faculty to the article in the *Journal of Dental Education* that presents the competencies (83 percent), charging the curriculum committee to review the school's existing competencies (74 percent), and distributing the new competencies to the faculty (46 percent).

Respondents were asked for their perspectives on the reasons why their curriculum is in its current format, i.e., what factors have been principal influences on the design of the curriculum. The following factors were ranked as "highly important" or "important" by more than 55 percent of respondents:

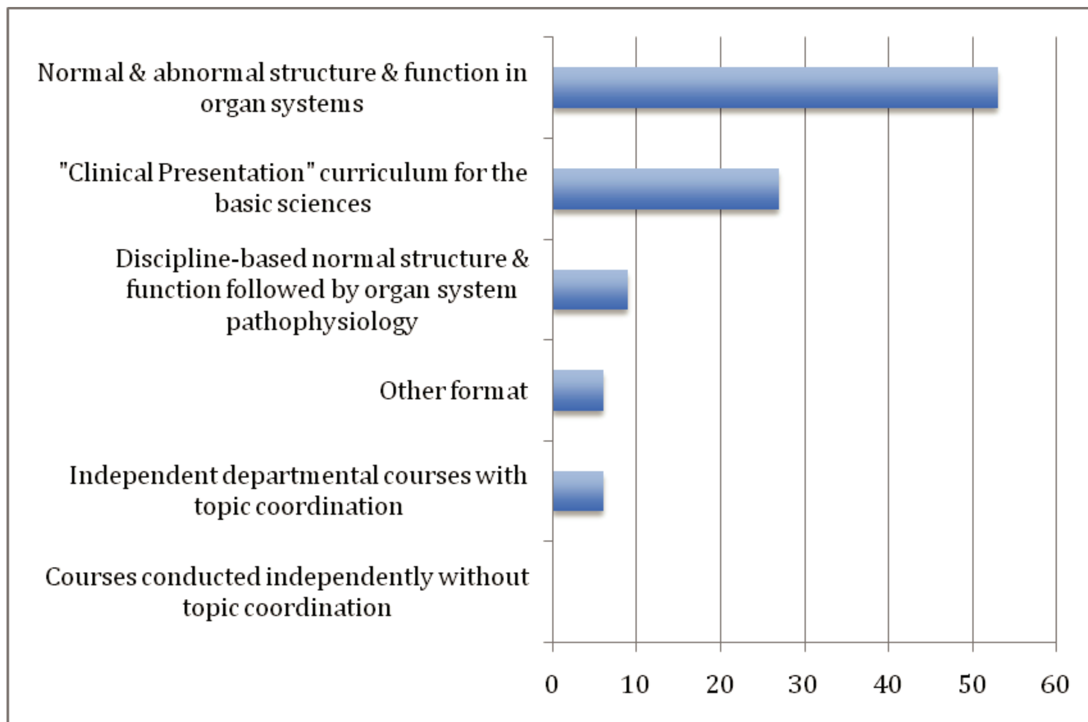

Figure 4. Most preferred basic science curriculum model, by percent of total responses (N=55 dental schools)

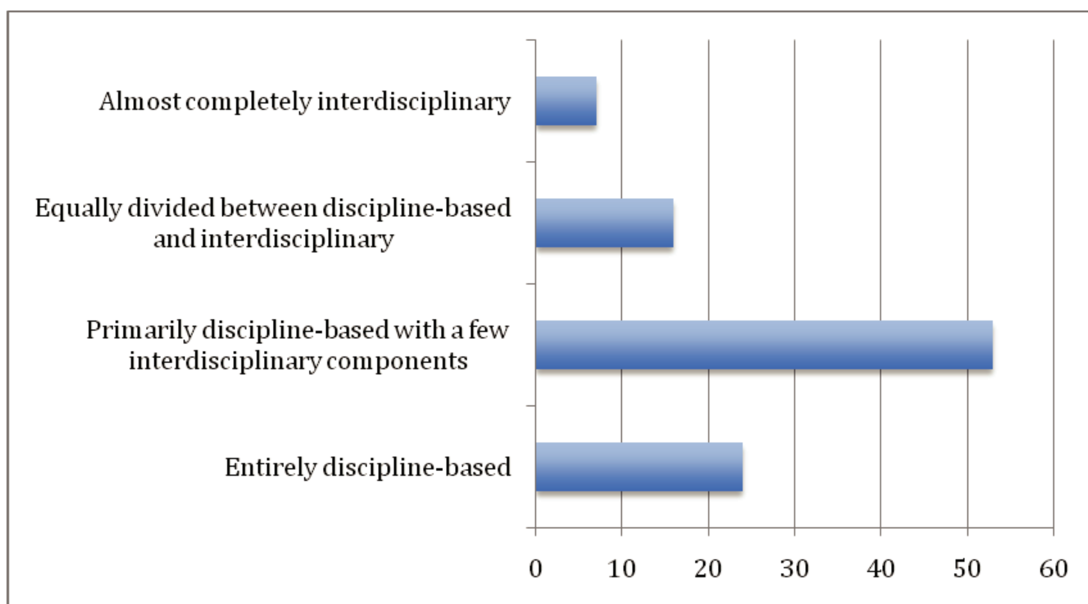

Figure 5. Organization of the clinical sciences curriculum, by percent of total responses (N=55 dental schools)

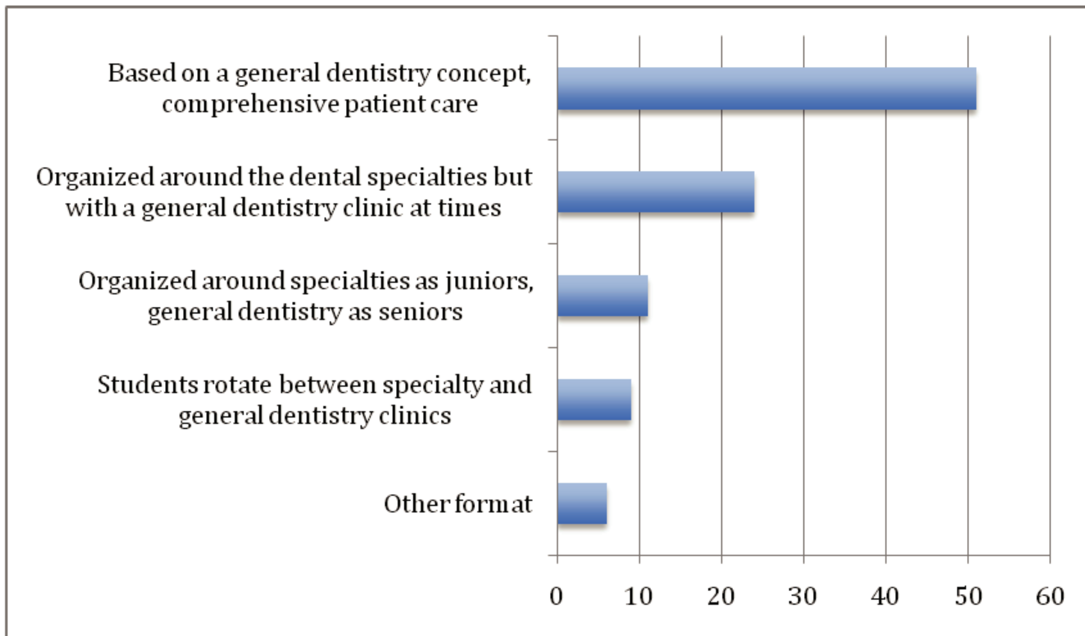

Figure 6. Organization of students' learning in the clinic, by percent of total responses (N=55 dental schools)

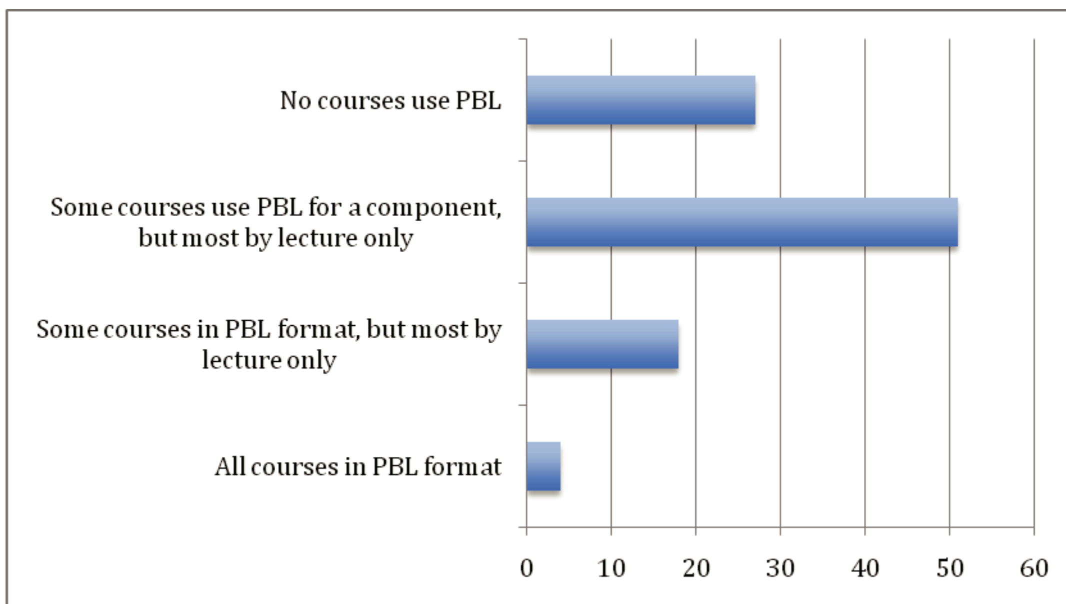

Figure 7. Use of PBL in the curriculum outside of the clinic, by percent of total responses (N=55 dental schools)

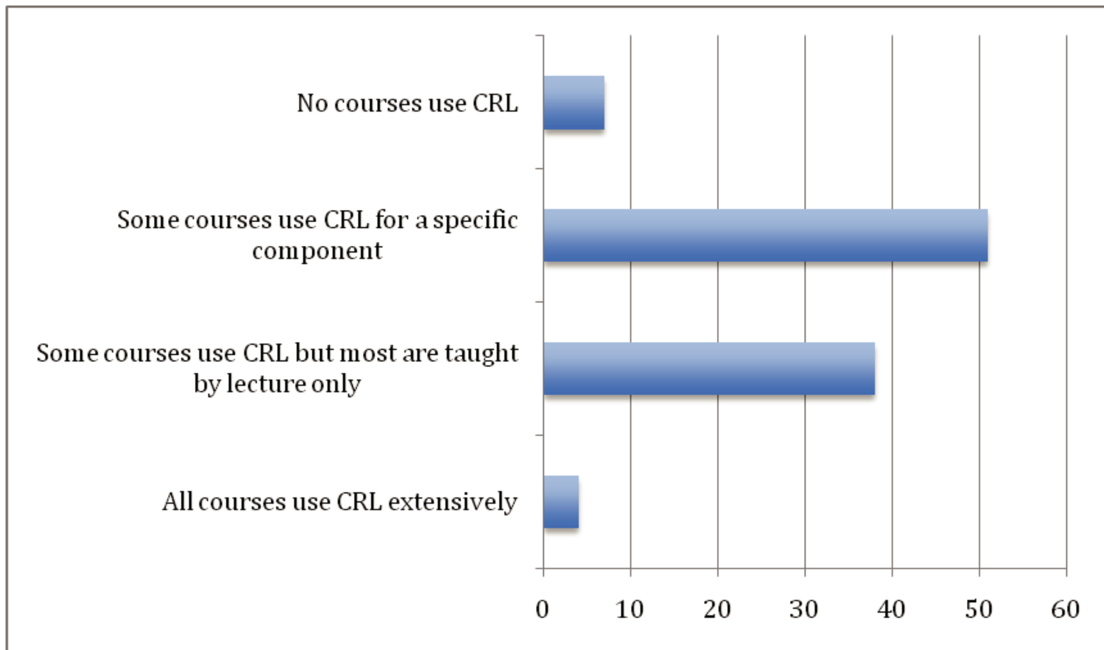

Figure 8. Use of CRL in the curriculum outside of the clinic, by percent of total responses (N=55 dental schools)

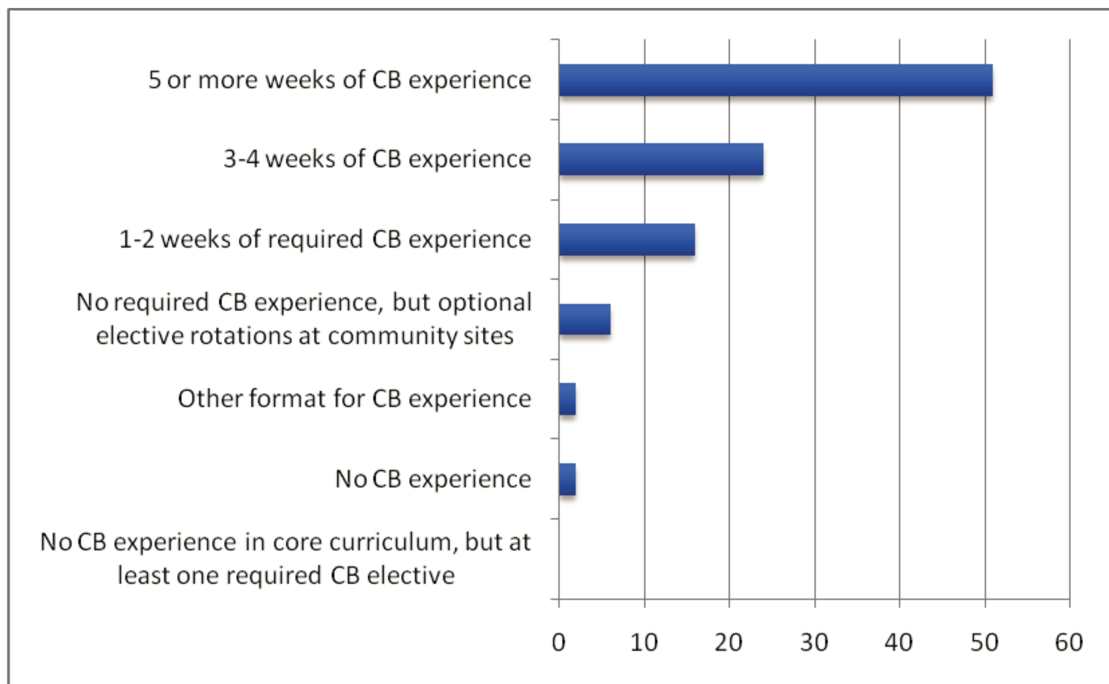

Figure 9. Community-based (CB) clinical experiences, by percent of total responses (N=55 dental schools)

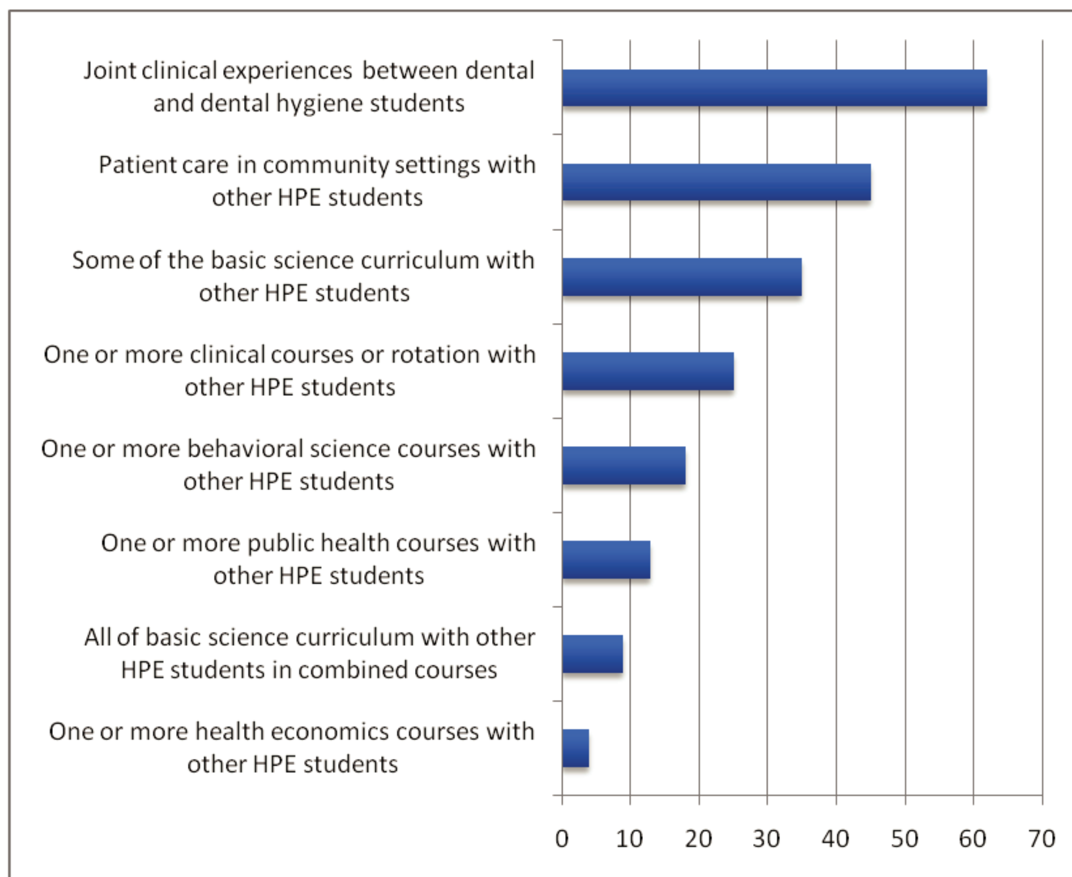

Figure 10. Extent to which dental students take courses with students from other health professions education (HPE) programs, by percent of total responses (N=53 to 55 dental schools)

capacity—the curriculum is perceived to be "do-able" given existing resources (80 percent); success—the curriculum "works," graduates do well, and the school's reputation in the community is good (79 percent); comfort of the faculty with the curriculum (76 percent); compatibility with research and service missions (73 percent); resources—the curriculum is consistent with available resources (75 percent); tradition—the curriculum reflects long-standing values of the school (70 percent); evidence—modeling the curriculum after evidence-based best practices (68 percent); fit—the curriculum matches the type of teaching preferred by the faculty (69 percent); harmony—the current curriculum keeps most departments and faculty members happy (57 percent); and familiarity—faculty members are experienced with the current curriculum and not familiar with other educational models (55 percent).

Reasons that were perceived as "marginally important," "not important," or "does not apply" by more than 50 percent of respondents were the following: control—lack of control of faculty or facilities; lack of alternatives—not aware of a better model; uncertainty of change—unattractiveness of switching to an alternative model with uncertain outcomes; negative experiences—previous failed efforts with other curriculum formats; mandate—legislative requirements for a certain format or outcome; and vision—curriculum reflecting the vision of an influential or respected dental educator. Table 2 shows response frequencies for each of curriculum format influences listed in this question. Fourteen schools provided additional comments related to this question, with most indicating that the curriculum is in flux or will be changed. Some respondents indicated that the question was difficult to answer, provided

Table 1. Actions taken related to the 2008 Competencies for the New General Dentist published by ADEA in the *Journal of Dental Education* in July 2008, by percent of total responses

	Already Done	Not Yet, But Will Do This	Do Not Plan To Do This	Have Not Decided Yet	N
Alert faculty to the publication	83%	11%	4%	2%	54
Distribute copy of the competencies to all faculty members	46%	24%	18%	11%	54
Send competencies to course directors for review of course objectives	30%	32%	24%	15%	54
Request departments to review competencies and identify related teaching obligations	30%	35%	22%	13%	54
Charge curriculum committee to review school's existing competencies	74%	20%	2%	4%	54
Present competencies at faculty meeting and discuss implications	24%	28%	30%	18%	54
Other actions	34%	2%	15%	49%	41

Note: Percentages may not total 100% because of rounding.

Table 2. Reasons for the current format of the curriculum, by percent of total responses

Reason	Highly Important	Important	Marginally Important	Not Important	Does Not Apply	N
Success	46%	33%	16%	0	6%	55
Capacity	37%	43%	9%	6%	6%	54
Tradition	33%	37%	13%	11%	6%	54
Compatibility	27%	46%	22%	5%	0	55
Resources	26%	49%	13%	8%	6%	53
Evidence	24%	44%	20%	6%	8%	55
Comfort	22%	54%	15%	6%	4%	54
Familiarity	22%	33%	16%	20%	9%	55
Uncertainty of Change	18%	24%	26%	17%	15%	54
Control	16%	22%	18%	18%	25%	55
Fit	13%	56%	24%	5%	4%	54
Vision	11%	9%	22%	29%	29%	55
Harmony	9%	48%	28%	9%	6%	54
Lack of Alternatives	6%	24%	22%	35%	13%	54
Negative Experiences	4%	13%	29%	27%	27%	55
Mandate	0	6%	4%	31%	60%	55

Note: Percentages may not total 100% because of rounding.

alternative reasons for curriculum format, or expressed dissatisfaction with the question.

Respondents were provided with a definition of "competency-based education" as described above and were informed that the Commission on Dental Accreditation (CODA) and ADEA both identify CBE as the model for predoctoral dental education and an "entry-level general dentist" as the outcome. They were then asked to estimate their faculty's awareness of these positions. A high proportion of respondents indicated faculty awareness and agreement with that model and outcome. A smaller proportion indicated that their faculty could describe the concepts underlying CBE (Table 3).

The survey asked respondents to provide other unstructured comments about the format of their predoctoral curriculum. Most of the responses described curriculum changes in process or planned.

Curriculum Assessment Methods

Respondents were asked to indicate the value of twenty data sources, standards, and methods for assessing the curriculum by answering this question: "Please indicate the importance of the following data sources for assessment of the curriculum at your school." As shown in Table 4, five items were identified as "highly important" by at least 40 percent of the respondents: students' performance on

Table 3. Estimation of faculty awareness of competency-based education (CBE) as the ADEA and CODA model for dental education and "an entry-level dentist" as the outcome, by percent of total responses

	Agree	Uncertain	Disagree	N
Most faculty members are aware that CBE is the model for the dental school curriculum.	80%	7%	14%	55
Most faculty members can describe the concepts underlying CBE.	47%	27%	26%	55
Most faculty members are aware that an entry-level general dentist is the designated outcome.	89%	9%	2%	55
Most faculty members agree that an entry-level general dentist is the appropriate outcome.	84%	11%	6%	55

Note: Percentages may not total 100% because of rounding.

Table 4. Importance of data sources for evaluation of the curriculum, by percent of total responses (N=53 dental schools)

Data Source	Highly Important	Important	Marginally Important	Not Important/ Not Used
Student Performance on Exams	68%	28%	4%	0
CODA Educational Standards	57%	32%	9%	2%
Institutional Self-Study	56%	36%	0	8%
Licensure Pass Rates	53%	34%	9%	4%
Faculty Evaluations	42%	40%	15%	4%
National Board Results	38%	38%	15%	9%
Students' Evaluations of Courses and Instructors	38%	51%	9%	2%
Faculty Opinions	33%	60%	8%	0
Student Performance on Mock Boards	28%	43%	19%	9%
Alumni Opinions	26%	55%	17%	2%
Student Attrition Rates	25%	40%	12%	23%
Community Practitioners' Views	21%	57%	17%	6%
Career Choices of Graduates	19%	49%	17%	15%
ADEA CCI White Papers	17%	38%	26%	19%
% Graduates Admitted to Other Prestigious Postgraduate Programs	15%	42%	26%	17%
External Consultants	11%	43%	32%	13%
% Graduates Admitted to Our Postgraduate Programs	9%	47%	28%	15%
Comparison of Courses to NBDE Subject Outlines	9%	47%	26%	17%
Comparison to Data in ADA Survey of Dental Education	9%	38%	40%	13%
Comparison to Recommendations of National Organizations/Panels	8%	50%	33%	10%

Note: Percentages may not total 100% because of rounding.

final exams and competency exams (68 percent), educational standards of the Commission on Dental Accreditation (57 percent), findings of an institutional self-study conducted by the school (56 percent), pass rates on licensure examinations (53 percent), and faculty evaluations of the curriculum, e.g., peer review (42 percent). A number of items were identified as "marginally important" or "not important/not used" by more than 40 percent of respondents: the ADEA CCI white papers, number of graduates who are admitted into prestigious postgraduate programs at other institutions, external consultants, number of graduates admitted into postgraduate programs at their own institution, the subject matter outlines (e.g., topic specification) for the National Board Dental Examination, national curriculum data available in the ADA Survey of Dental Education, and curriculum recommendations by national organizations or blue-ribbon panels.

Respondents were asked to indicate how students are involved in curriculum evaluation and how data from student evaluations are disseminated and used in the overall assessment process. As shown in Table 5, most of the responding schools rely heavily on student evaluations. Ninety-one percent of respondents reported that students evaluate all

courses, 90 percent indicated that seniors provide an overall evaluation of the entire curriculum before they graduate, and 89 percent reported that students evaluate the performance of course directors. These and other aspects of students' evaluation of their educational experiences and the use of these data are displayed in Table 5.

The survey inquired about the most recent broad-based, comprehensive assessment of the curriculum. Forty-two percent of respondents responded that their most recent comprehensive curriculum review was conducted in 2009 or is currently under way. Twenty-three percent reported that a curriculum review was most recently performed in 2008. Only four schools indicated that it had occurred more than five years ago (Figure 11).

Table 6 displays dental schools' self-reported implementation of various curricular innovations. Among innovations frequently advocated in the dental education literature, the one reported by respondents as most frequently incorporated (64 percent) was "establishing clinical group practice teams to provide continuity in faculty-student relationships." The second most frequently implemented innovation was "increasing student interaction with patients in the first and second years" (51 percent), with an additional 42 percent indicating that this change was currently in planning and soon to be implemented. The "innovation" selected as "not in our plans" by the highest percentage of respondents (89 percent) was "establishing articulation agreements where dental students can take designated courses at other schools and transfer credits to our program." Other items that were low priorities for many schools were "create an in-school internship of one semester duration to replicate general dentistry environment and assess students' capacity to 'put it all together'" (71 percent); "implement problem-based learning in substantial sections of the curriculum" (60 percent); and "create a readiness-based versus time-based educational program where students move at their own pace through the curriculum based on individual competence" (60 percent).

Respondents were asked to indicate the factors that triggered curriculum change at their schools. The responses are summarized in Table 7. The catalysts for curricular change that were most often selected as "highly important" or "important" were "findings of a curriculum review we conducted ourselves" (86 percent); "students' feedback about curriculum" (83 percent); "educational best practices reported in the literature" (80 percent); "scientific evidence that needs to be incorporated into the curriculum" (77 percent); "expansion of research or service missions which influenced educational mission" (74 percent); "administration dissatisfaction with curriculum" (72 percent); and "faculty dissatisfaction with curriculum" (70 percent). The catalysts for curricular change identified most often as "not important or does not apply" were "declining number of applications for admission and feedback from applicants about the school" (79 percent); "mandates from legislature or parent university" (68 percent); "other dental schools in our region that compete for the same applicant pool

Table 5. Students' evaluation of instructors and the curriculum, by percent of total responses

	Yes	Sometimes	No	N
Students evaluate each course.	91%	9%	0	53
Students evaluate course directors.	89%	11%	0	53
Students evaluate each classroom instructor.	68%	30%	2%	53
Students evaluate each lab instructor.	69%	31%	0	52
Students evaluate each clinic instructor.	64%	32%	4%	53
Students evaluate overall year's curriculum at the end of each year they just concluded.	29%	19%	52%	52
Seniors evaluate overall curriculum prior to graduation.	90%	6%	4%	52
Students complete majority of evaluations online.	71%	10%	19%	52
Measures are used to encourage student evaluations, such as withholding grades.	42%	15%	42%	52
Focus groups explore student perceptions of the curriculum.	44%	40%	15%	52
Curriculum committee reviews students' evaluations.	65%	19%	15%	52
Associate dean for academic affairs reviews students' evaluations.	76%	17%	7%	53
Students' evaluations are sent to all faculty involved in each course.	58%	23%	19%	52
Students' evaluations are sent to course directors.	91%	6%	4%	53
Students' evaluations are sent to department chairs.	83%	11%	6%	53

Note: Percentages may not total 100% because of rounding.

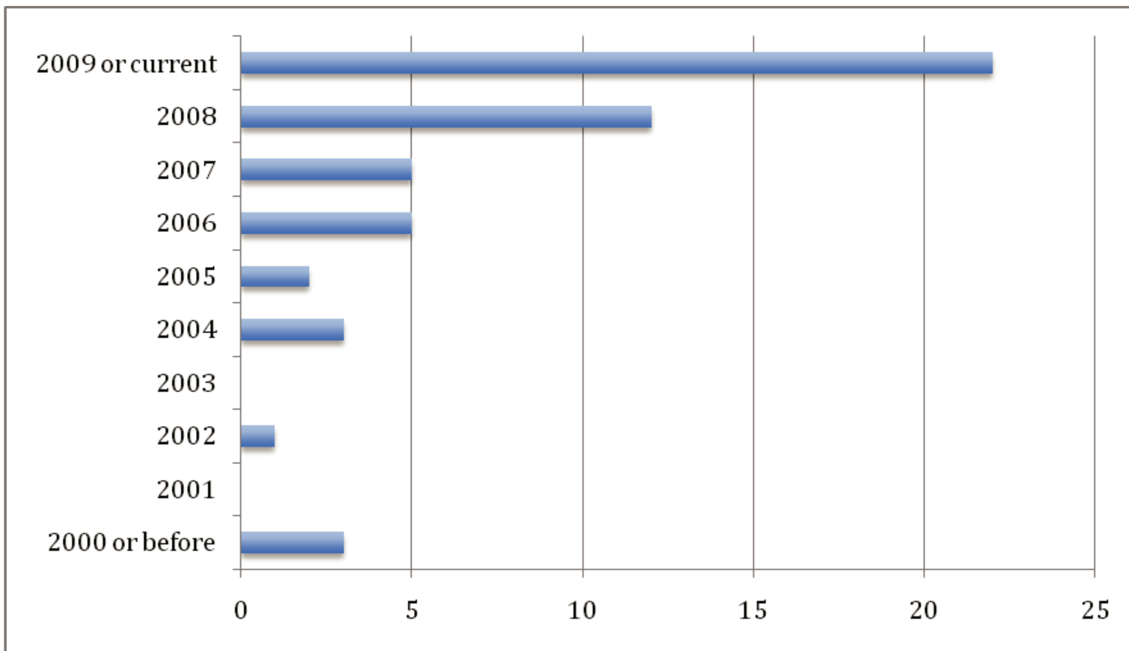

Figure 11. Year of most recent comprehensive curriculum review, by number of schools (total of fifty-three responded)

Table 6. Implementation of curriculum innovations, by percent of total responses

Innovation	Completed	In Progress	3-Year Priority	Not in Plans	N
Curriculum decompression	28%	43%	24%	4%	53
Increase community-based patient care	46%	33%	19%	2%	52
Interdisciplinary curriculum around themes	21%	19%	27%	33%	52
Blend basic and clinical sciences (diseases then biological principles)	19%	17%	32%	32%	53
Organ system model for basic sciences	21%	17%	11%	51%	53
Increase student interaction with patients in first and second years	51%	42%	8%	0	53
Online core curriculum	18%	18%	39%	25%	51
PBL for substantial portions	17%	15%	8%	60%	53
Articulation agreements with transfer of credits	2%	4%	6%	89%	53
In-school general dentistry internship of one semester	14%	6%	10%	71%	52
New techniques for assessing competency, e.g., OSCEs, triple jump, portfolio	30%	24%	32%	13%	53
Students move at own pace through the curriculum	9%	13%	17%	60%	53
Create dual-degree tracks	38%	11%	15%	36%	53
More opportunities for student research	47%	32%	17%	4%	53
Collaborations with other HPE schools	23%	28%	26%	23%	53
Emphasize interactions of oral and systemic disease	43%	37%	21%	0	53
Expand learning of evidence-based practice and critical appraisal of evidence	24%	53%	21%	2%	53
Clinical student-faculty group practice teams	64%	19%	6%	12%	52
Curricular track selectives	8%	9%	30%	53%	53
Increased exposure to academic careers	32%	30%	26%	11%	53
Designate courses in basic biological principles as admission requirements	36%	9%	17%	38%	53
Develop and assess capacity for critical thinking	28%	45%	23%	4%	53

Note: Percentages may not total 100% because of rounding.

Table 7. Importance of selected catalysts for curricular change, by percent of total responses

Catalyst	Highly Important	Important	Marginally Important	Not Important	N
Educational best practices in the literature	48%	33%	15%	4%	52
Internal curriculum review	46%	40%	10%	4%	52
Administration dissatisfaction	38%	36%	8%	19%	53
Committee/task force recommendations	36%	24%	19%	21%	53
New scientific evidence that needs incorporation	35%	42%	15%	8%	52
Student feedback	34%	49%	11%	6%	53
New dean's ideas	30%	23%	8%	40%	53
Accreditation site visit	28%	13%	28%	30%	53
Performance on national boards and licensing exams	23%	34%	19%	24%	53
New ADEA competencies	23%	28%	36%	13%	53
Faculty dissatisfaction	17%	53%	13%	17%	53
Physical plant changes	17%	19%	15%	49%	53
Changes in parent university/health science center	13%	30%	28%	28%	53
Economic conditions	13%	21%	19%	47%	53
Leadership of an influential faculty member	13%	45%	19%	23%	53
Mock site visit by consultants	12%	20%	22%	47%	51
Alumni feedback	11%	43%	24%	21%	53
Reduced faculty numbers or experience	8%	36%	19%	38%	53
Faculty visits to other schools	6%	40%	30%	24%	53
External consultants	6%	19%	30%	45%	53
Legislative or university mandates	6%	8%	19%	68%	53
Grants, donations, gifts	4%	8%	32%	57%	53
Curricular change in other schools in the region	2%	2%	28%	68%	53
Declining number of applicants and feedback from applicants	0	9%	11%	79%	53

Note: Percentages may not total 100% because of rounding.

made curriculum changes" (68 percent); and "grants, donations, or alumni gifts" (57 percent).

Resources Needed for Curriculum Enhancement

Respondents were asked to identify resources necessary to support curriculum innovation at their schools. Professional development for both new and established faculty members related to curriculum design, teaching strategies, and assessment methods was identified as "highly important" or "important" by approximately 90 percent of respondents. Next was expansion of capacity in information technology, with 92 percent indicating it was "highly important" or "important." More than 70 percent rated the following resources as "highly important" or "important": budget for planning and testing of curriculum innovations; examples of innovative curriculum formats from other dental schools; and protected time for faculty members to plan curriculum innovations. Respondents' ratings of needed resources and actions to support curriculum innovation appear in Table 8.

Respondents also were asked what ADEA could do to assist schools' efforts to enhance their curricula. Provision of grants to support pilot-testing of new curriculum models was the factor selected most often (60 percent) as "highly important" from a list of potential ADEA actions, followed by "conduct research studies to explore outcomes of new curriculum and assessment strategies" (55 percent) and "disseminate curriculum models from dental schools that have implemented innovations" (53 percent). Table 9 provides the respondents' ratings of potentially helpful actions by ADEA.

Discussion

The number of U.S. and Canadian dental schools responding to this survey (n=55; 86 percent) was virtually identical to that in the 2002–03 survey (N=56, 87 percent response),[5] except that there were two more U.S. schools and three fewer Canadian schools represented in the responses to the current survey.

Table 8. Importance of resources and actions needed for achieving planned curriculum enhancement, by percent of total responses (N=53 dental schools)

Resource	Highly Important	Important	Marginally Important	Not Important
Training for new faculty in teaching skills	55%	38%	6%	2%
Professional development for established faculty	51%	36%	13%	0
Expansion of information technology	49%	43%	8%	0
Budget	34%	43%	17%	6%
Protected time for faculty to plan curriculum innovations	32%	40%	21%	7%
Incentives and rewards for educational innovations	28%	32%	26%	13%
Modifications of physical plant	26%	42%	26%	6%
Educational consultants	23%	38%	40%	0
Examples of formats from other schools	23%	57%	21%	0
Enhanced grant writing capacity to secure needed funds	23%	30%	30%	17%
Site visits to other schools	17%	49%	30%	4%
Fellowships and sabbaticals for faculty	13%	25%	34%	28%

Note: Percentages may not total 100% because of rounding.

Table 9. Importance of actions by ADEA to support curriculum innovation, by percent of total responses

Action	Highly Important	Important	Marginally Important	Not Important	N
ADEA CCI Liaisons to promote faculty development locally	32%	40%	21%	7%	53
Disseminate curriculum models from other schools	53%	40%	6%	2%	53
Provide grants to support pilot-testing of new models	60%	28%	8%	4%	53
Establish expert panels to develop and disseminate models	43%	36%	15%	6%	53
Seminars at ADEA Annual Sessions for schools to provide outcomes of reform	47%	45%	6%	2%	53
Research to explore outcomes of new strategies	55%	34%	9%	2%	53
Designate "lab schools" for piloting innovations	22%	33%	38%	8%	51
Annual theme issue of *JDE* on curriculum innovation	49%	36%	13%	2%	53
White paper in *JDE* on innovations in other HPE programs	43%	36%	19%	2%	53

Note: Percentages may not total 100% because of rounding.

In the seven years since the previous survey, schools have been very active in conducting comprehensive curriculum reviews, with all but four of the responding schools indicating that such reviews had occurred since the earlier survey. The time period between the 2002–03 and 2009 surveys parallels two phenomena in dental educational nationally: the publication of numerous position and advocacy papers in the literature arguing for curricular reform, and the creation and work of the ADEA CCI. The high level of curriculum review in recent years is likely a byproduct of these two phenomena, but the survey did not explore a causal association. One could reasonably anticipate that the 2009 survey would reveal that a fair amount of curriculum change had occurred as a consequence of this review process at dental schools. This assumption was true in at least some respects, but not so much in others. One way to explore the extent of change is to compare "innovations" for which a response was requested in both surveys. An attempt to make such comparisons appears in Table 10, comparing corresponding data from the 2002–03 survey to results in the current survey.[5] Differences in wording in the two surveys dictate caution in interpretation, but it would appear that dental schools have increased utilization of the following during the past seven years: community-based care; interaction with patients by students in their first and second years; opportunity for student research; and use of group practice teams in the clinic. In most cases, the increase was small, but that was partially due in most instances to a substantial base of incorporation of the "innovation" already by 2002–03.

Table 10. Comparison of curricular innovations reported as "already incorporated" in 2002–03 (N=56 schools) to 2009 responses (N=51 to 53 schools) as "completed" or "in progress," by percent of total responses

Innovation	2002–03	2009	Change
Decompress curriculum	79%	71%	Uncertain
Increase community-based care	50%	79%	Increased
Increased interaction with patients in first and second years	84%	93%	Some increase
Articulation agreements	7%	6%	No change
Better methods for assessing competence	84%	54%	Uncertain
Students move through curriculum at own pace	36%	22%	Uncertain
Create dual-degree tracks	27%	49%	Increased
More opportunity for student research	71%	79%	Some increase
Collaborations with other HPE schools	55%	51%	Nothing additional
PBL for substantial portions of curriculum	23%	32%	Some increase
Evidence-based practice	75%	77%	No change
Group practice teams	52%	64%	Some increase

Source: 2002–03 percentages are from Table 8 in Kassebaum DK, Hendricson WD, Taft T, Haden NK. The dental curriculum at North American dental institutions in 2002–03: a survey of current structure, recent innovations, and planned changes. J Dent Educ 2004;68(9):914–31.

Creation of dual-degree tracks also appeared to have increased. In 2002–03, this concept was specified as a D.D.S.-Ph.D. track, while "dual-degree tracks" was the wording in 2009. Some or all of the numerical increase in responses, therefore, could be due to dual degree programs other than the D.D.S.-Ph.D.

"Better methods for assessing competence" appeared on the face of it to have actually declined substantially in the responding schools. Again, that possibly may be accounted for by wording differences between the two surveys. In 2009, "OSCEs, triple jump, portfolio" were specified as examples, which was not the case in the 2002–03 survey on which no examples were given. An apparent decrease in "students moving through the curriculum at their own pace" could also be due to wording differences between the two surveys. In 2002–03, this item was termed "competency-based vs. time-based curriculum." Different people responding to the two surveys could account for the apparent decrease in "decompress curriculum" at least in part. Individuals responding in 2009 who were not respondents in 2002–03 may have seen the issue of "decompression" as an activity occurring only during their tenure in the position, not prior to 2002–03, when a significant proportion of respondents indicated that it had already occurred.

Overall, the most striking change was a substantial increase in the proportion of schools (91 percent, up from 64 percent) that *require* some community-based clinical experience. Half of the responding schools (51 percent) now require five or more weeks in the community sites. Whereas 41 percent of responding schools in 2002–03 either had an elective or no community-based experience, that proportion was down to 6 percent (three schools) in 2009. This change is consistent with the fact that 53 percent of the schools reported in 2002–03 that they intended to increase patient care provided by students at community sites.

Also, there was a decline from 66 percent to 49 percent in the proportion of schools that reported a primarily discipline-based curriculum with just a few interdisciplinary courses. Interestingly, while the majority of schools reported a basic science curriculum that was primarily discipline-based (either independent departmental courses with either no or some topic coordination or discipline-based courses followed by organ system pathophysiology), a majority (53 percent) of the respondents favored an organ system approach. While the teaching of basic sciences in dental school curricula has changed over the past seven years somewhat toward a more interdisciplinary format, that part of the curriculum apparently has not yet done so to the extent that academic administrators would prefer. This phenomenon may be due to the fact that some schools rely on faculty members from medical schools and other areas external to the dental school to provide basic science instruction. The change from departmental "silo" instruction to interdisciplinary learning experiences has been less marked in the clinical disciplines, apparently both didactically and clinically.

Dental specialties remain major factors in the organization of students' learning in the clinic. Even though there was some increase in the creation of group practice teams, only a very small majority of schools have adopted a general dentistry, comprehensive patient care concept. This was not explored in the 2002–03 survey, so it is uncertain if that has changed in the past seven years.

There was a small increase in the extent to which PBL is used in dental school curricula. A slightly greater proportion of schools now use PBL for some component of their courses than in 2002–03, 51 percent vs. 45 percent, but 36 percent of schools in 2009 had no courses with a PBL component versus 27 percent in 2002–03. There was no increase in the number of schools that use PBL for all courses, and a clear majority said that PBL for substantial portions of the curriculum was not in the plans. Similarly, the use of CRL in the curriculum outside of the clinic declined slightly, 57 percent using it for some course components in 2002–03 versus 51 percent in 2009. These data suggest that the PBL and CRL teaching/learning strategies appear to have penetrated some time ago about as much as they are likely to.

Seven years ago, 55 percent of the respondents indicated they had already increased educational collaborations with other health professions schools on their campus. In the 2009 survey, respondents answered in a similar manner, with 52 percent indicating that such collaborations had already been completed or were in progress. These data suggest that more than half of dental schools have made a commitment to interprofessional education and that this commitment has been in place for a number of years. Forty-three percent of the 2009 respondents indicated that their students share patient care in community settings with other HPE students and about three-quarters have at least some courses with other HPE students.

Competency-based education (CBE) appears well established as the norm in responding dental schools, and respondents endorsed the concept that an "entry-level general dentist" is the desired product of predoctoral dental education. According to the current survey, most dental school faculty members are well aware that CBE is the educational model for both CODA and ADEA. However, and consistent with the findings of a recent study by Licari and Chambers,[7] the survey respondents did not believe that most members of their faculty could describe the core characteristics of CBE. Most schools have also alerted their faculty to the updated 2008 competencies published by ADEA and have taken action, such as charging a curriculum committee with reviewing the school's existing competencies in their light.

Data sources for evaluation of the curriculum remained largely the same and relatively of the same magnitude of importance between the two surveys. The 2009 data indicate that dental schools rely on traditional measures of educational outcomes: student exam performance, CODA standards for educational programs, school-administered self-studies, licensure exam pass rates, national board pass rates, and student and faculty evaluations of the curriculum. Schools place less value, and less frequently use, a number of other external data sources, including the subject matter (topic specification) outlines for the national board examinations, the national curriculum database reported in the ADA Survey of Dental Education, and recommendations published by national organizations and educational panels/commissions.

The ADEA CCI white papers were an addition in the current survey, as they had not been written prior to the earlier survey. From 2005 to 2009 ADEA published twenty-one white papers in the *Journal of Dental Education* (*JDE*) on curriculum change and innovation. The articles were intended to inform educators and stimulate dialogue about the future directions of dental education. ADEA formed the ADEA CCI to oversee and guide the Association's educational change efforts. Several of these white papers are among the most-cited *JDE* articles in recent years, suggesting that some of the ADEA CCI white papers have become influential in the curriculum evaluation and change efforts occurring at dental schools across the country.

Students' evaluations of courses and teachers were not addressed in the 2002–03 survey, but the current survey reveals that 90 percent of schools have students evaluate all courses as they move through the predoctoral program and ask seniors to evaluate the overall curriculum prior to their graduation. The extent to which these evaluations influence curricular change could not be assessed by the construct of the survey, but 89 percent of the respondents indicated that student evaluations are a critical data source for curriculum assessment, so one can assume that they are important.

One might argue that the "curriculum innovations" addressed in the 2009 and earlier surveys represent process issues more than fundamental reform. For instance, the following components have been core features of predoctoral dental education in the United States for nearly ninety years: a four-year time frame; students attend full-time;

students are primarily educated in one on-campus facility typically located at an urban university or academic health center; virtually all dental students complete an 800-hour basic science curriculum without individualization based on their predental education; students receive the bulk of their clinical education in an on-campus dental clinic; and all students proceed through a lock-step progression completing the same courses in the same sequence without individualization. While the 2009 survey did not ask specifically for direct input on the type of reform that would alter these or other standard features, where it came close to doing so, there was not much suggestion that far-reaching reform is on the horizon. For example, a majority of responding schools do not plan to implement selectives to allow diversification of educational experience (only 17 percent have such a program under way), and 60 percent do not plan to allow students to move at an individualized pace, based on readiness, through the curriculum, although this is a fundamental principle of competency-based education. Also, nothing in the open-ended comments solicited at the end of each question spoke to transformational reforms, in terms of curriculum modifications already accomplished, although a few suggested that fundamental change could be made, e.g., requiring all basic sciences as prerequisites to admission.

Several factors seemed to be much more important as catalysts for changing the curriculum in 2009 than they were in 2002–03. These included an internal curriculum review, student feedback, administrative dissatisfaction with the curriculum, and similar faculty dissatisfaction (Table 11). Not mentioned in the 2002–03 survey, new scientific evidence was also an important catalyst. Also, half of the schools reported the new ADEA competencies,[3] which had not been published prior to the earlier survey, as an important catalyst. Notably, the primary reasons cited for the nature of current curricula were related to "compatibility with faculty preferences," "faculty comfort," and "capacity/feasibility." Vision as a compelling factor for curriculum format was rated as an unimportant consideration.

Essentially all of the resources and actions that were listed in both surveys were selected as important by a higher percentage of respondents in 2009 than in 2002–03. This may be due in part to reductions in both faculty size and budgets that schools have experienced in recent years.[8] It may also reflect greater perceived urgency for curricular change.

In 2002–03, 91 percent of the respondents perceived that efforts of ADEA or other organizations could positively influence changes in the curriculum in their schools. This remains the case, as a majority of respondents in the current survey rated as "highly important" or "important" all nine of the potential actions by ADEA that were listed in the survey question.

For the future, responding schools indicated the following activities as the highest priorities for the next three years: create interdisciplinary curriculum around themes; blend basic and clinical sciences; implement online core curriculum; develop new techniques for assessing competence; collaborate with other HPE schools; and establish selectives to augment the curriculum.

The respondents viewed faculty development and expansion of information technology capability as the greatest resource needs to support curriculum change.

Table 11. Catalysts for curricular change that were reported as "highly important" or "important" compared to the reported "reasons for considering curricular change" in 2002–03, by percent of total responses

Catalyst	Important or Highly Important in 2009	A Reason for Change in 2002–03
Internal curriculum review	86%	34%
Student feedback	83%	38%
Administrative dissatisfaction	76%	43%
Faculty dissatisfaction	70%	27%

Source: 2002–03 percentages are from Table 8 in Kassebaum DK, Hendricson WD, Taft T, Haden NK. The dental curriculum at North American dental institutions in 2002–03: a survey of current structure, recent innovations, and planned changes. J Dent Educ 2004;68(9):914–31.

Conclusions

The primary conclusions of this study are as follows:

1. In the past seven years, dental schools have been very active in reviewing and modifying their curricula.
2. The largest change was the increased proportion of schools requiring community-based experiences for students.
3. There was an increase in interdisciplinary courses, especially in the basic sciences.
4. The usage of PBL and CRL in dental curricula appears to have stabilized, without projections for much increase in the future.
5. Competency-based education is the accepted norm in dental education.
6. Evaluation of curricula and their components by students is widely practiced in dental schools.
7. The top priorities for future curriculum modification, at schools that have not already implemented these changes, are interdisciplinary curriculum around themes, blending of basic and clinical sciences, online core curriculum, new techniques for assessing competence, and collaborations with other HPE schools.
8. The greatest resource need for additional curriculum revision is development of faculty skills in teaching strategies, curriculum design, and assessment techniques.

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