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Evaluation of the UME-21 Initiative at 18 Medical Schools Between 1999 and 2001

J. Jon Veloski, MS; Barbara Barzansky, PhD

Background: *This study evaluated the processes of curricular change and the initial outcomes of the Undergraduate Medical Education for the 21st Century (UME-21) project at 18 schools. **Methods:** Site visits were conducted at eight partner schools in 1999 and 2001. Written proposals, progress reports, and final reports of 18 schools were reviewed. Senior medical students' responses to questionnaires, including the annual Association of American Medical Colleges Graduation Questionnaire and a UME-21 supplemental graduation questionnaire, were analyzed. **Results:** There was variation among the schools in the curriculum at baseline, in the structure of the UME-21 innovation that was introduced, and in the process of implementation. There was an increase in seniors' ratings of instruction in the newer areas of evidence-based medicine, quality assurance, and cost-effectiveness in relation to national norms between 1999 and 2001. There was less impact on the more traditional content areas of ethics, patient communications, prevention, and leadership skills. **Conclusions:** The circumstances of the national evaluation introduced many methodological complexities, some of which could have been avoided if planning for evaluation had started earlier. However, the evaluation revealed that even modest funding directed toward specific curricular goals can produce measurable change and can have effects that extend beyond the initial scope of the project.*

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The goal of the Undergraduate Medical Education for the 21st Century (UME-21) program was to stimulate the introduction of opportunities for medical students to acquire knowledge, skills, and attitudes needed to perform effectively in the changing health care environment.^{1,2} Medical students were to receive instruction in nine content areas during the third year of the curriculum, with the curricular change being developed by a process involving the generalist disciplines and one or more external partners. This model of national funding to bring about change in medical education was similar to earlier initiatives.³⁻⁹

National evaluation of the UME-21 project included analysis of the process of change and an assessment of outcomes. The outcomes related to students' knowledge of, experience with, and attitudes toward the nine content areas that formed the core of the UME-21 initiative. This report describes the attainment of selected outcomes at the partner and associate schools and uses

medical schools that did not participate in UME-21 as a comparison group.

Methods

Data were collected between October 1998 and 2002. Sources included the schools' original proposals submitted in early 1998, written progress reports, interviews and document review during site visits to the partner schools, and surveys of seniors at all 18 schools.

Review of Proposals and Written Reports

Each school's proposal was used to assess the baseline status of the school before UME-21 and to characterize the school's goals and plans for its 3-year UME-21 program. Each school submitted seven progress reports, one overview report, and a final report. In addition, each school contributed to nine content area reports, which were summaries of the content covered in each of the UME-21 content areas. These reports provided prospective information about the process of change and intermediate outcomes across 3 years. The schools' written final reports provided additional information about outcomes and about the factors that affected program implementation and long-term maintenance.

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Site Visits to Eight Partner Medical Schools

A formal site visit protocol (copy available on request) was developed by the authors and reviewed by the UME-21 Executive Committee. The protocol defined the titles of the individuals to be interviewed at each school, including the dean; one or more representatives of the external partner(s) in the health care environment; associate dean for curriculum; chairs in family medicine, internal medicine, and pediatrics; UME-21 program director, UME-21 internal evaluator; and a sample of medical students. The protocol contained questions about the goals of the UME-21 program at that school, planning and management, internal evaluation and outcomes, relationships with the external partner, and the nature of the local health care environment. Not every respondent was asked all questions, but each question was asked of more than one respondent at each school.

One site visit was conducted during the first year of the UME-21 initiative during the spring of 1999 and repeated around the same time in 2001 near the end of UME-21. The second site visit reviewed many of the same issues defined in the protocol but also addressed the outcomes of the UME-21 program and plans for continuation. The first site visit was conducted by one member of the Executive Committee and one member of the national evaluation team. The same national evaluator conducted the second site visit.

LCME Annual Medical School Questionnaire

The Liaison Committee on Medical Education (LCME) Annual Medical School Questionnaire for 1997–1998 was used to determine whether the UME-21 content areas were covered in the curriculum prior to the UME-21 project period. The questionnaire had been sent to the deans of all 125 LCME-accredited medical schools in February 1998 (100% response). It asked whether the following topics were included in the curriculum: communication skills, ethical problems in medicine, evidence-based medicine, health care systems, population-based medicine, and medical informatics.

AAMC Graduation Questionnaire

We reviewed the content of each item in the 1999, 2000, and 2001 versions of the Association of American Medical Colleges (AAMC) Graduation Questionnaire (GQ) and identified 29 items that appeared to be directly related to the nine content areas of UME-21 and which were administered consistently over the 3 years of the UME-21 project. For example, the UME-21 content area of health systems finance was linked to GQ items such as the relative amount of curricular instruction devoted to medical care cost control and the instruction dedicated to cost-effective medical practice. Quality measurement and improvement was linked to

an item dealing with the amount of instruction devoted to quality assurance in medicine. The mapping of the items to each of the nine UME-21 areas was distributed for review among the authors, the Executive Committee of the UME-21 program, and participants at the UME-21 annual meeting in 2000. There were 17 other items associated with the UME-21 but which were not unique to UME-21 content (eg, instruction in introduction to clinical medicine course, clinical experience with long-term health care, occupational medicine, etc). Although there were 56 other relevant items, these items were not administered consistently in the three different versions of the AAMC GQ between 1999 and 2001. In summary, 102 items from the AAMC GQ were considered over the 3-year evaluation, and 29 were eligible for use in the final analysis.

UME-21 Graduation Questionnaire

At the first annual meeting of the UME-21 schools, there was a consensus that it would be appropriate to survey seniors to gather additional uniform data across all schools related to the goals of UME-21. Subsequently, we worked with representatives of the eight partner schools to develop a brief questionnaire (a copy is available on request) to measure students' educational activities related to UME-21 that were not addressed in the AAMC GQ. For example, respondents were asked to indicate whether they had performed, assisted, or observed any of 21 specific activities related to UME-21 content. Examples of these activities include "Identify the total cost of a patient's hospital stay" and "Design a quality improvement loop for a clinical situation." In another section, students indicated their level of agreement with 24 statements designed to measure attitudes toward controversial issues in the changing health care environment. Examples of statements include "Good medical care is usually cost-effective care" and "The care of many chronically ill patients (eg, diabetics) can be managed safely by nurse practitioners."

Analysis of Questionnaire Data

The analysis examined the effects of the UME-21 project on the graduating classes of 1999, 2000, and 2001 at the 18 medical schools. The AAMC GQ responses of seniors at the partner and associate partner schools were compared to the responses of seniors at the other 107 US MD-granting schools using methods described previously.¹⁰ It was hypothesized that the UME-21 project would have the greatest influence on seniors at the UME-21 partner schools and less effect on those at the associate partner schools. Seniors at the 107 other schools were used as a comparison group, in which the smallest overall effect was hypothesized.

The review of proposals and reports confirmed that the three graduating classes would have to be analyzed separately. The graduating class of 1999 across the 18

schools was treated as a baseline cohort because that group had received no UME-21 intervention. Analysis of the program design and implementation schedules reported by the schools in their progress reports during the first year suggested that partial effects of the UME-21 intervention might be observed in the first intervention cohort, the class of 2000. For example, although nearly all of the partner schools implemented some changes to their third-year clinical curriculum at some point in the 1998–1999 academic year, the actual date of implementation and the arrangement of block rotations meant that all members of the class of 2000, who were the third-year students in that academic year, were not necessarily exposed to the entire UME-21 curriculum during the first year of the project. Further, large parts of the UME-21 curriculum at some schools were introduced into the second-year preclinical curriculum during the 1998–1999 academic year. This meant that any effect on graduate outcomes would not be expected until the class of 2001, when that cohort graduated. In summary, data for the class of 1999 represent a baseline with no UME-21 effect, responses for the class of 2000 reflect partial effects in most schools, and the class of 2001 reflects the strongest effect in the present analysis.

Response Rates

Responses to the AAMC GQ were available for 2,029 (80%) of the seniors from the UME-21 schools in 1999, 2,384 (92%) in 2000, and 2,371 (91%) in 2001. These overall rates are nearly identical to the national response rates of 81%, 90% and 91% in the same years. Although the response rates for individual schools in individual years ranged from 19% to 100% over the 3-year period, the vast majority (80%) of the schools had annual returns that exceeded a 75% response rate.

Responses to the UME-21 graduation questionnaire were available for 625 (54%) of the graduates of the eight partner schools in 1999, 835 (72%) in 2000, and 792 (67%) in 2001. The rates for individual schools in specific years ranged from 11% to 100%, with the vast majority above 56%.

Results

Characteristics of Partnerships

The site visits and progress reports from the UME-21 schools revealed partnerships with entities that were under the same organizational umbrella as the medical school (for example, with the faculty practice plan) and with external organizations. Examples of external partners included managed care organizations, city/county health departments, large multi-specialty group practices, an area health education center (AHEC), and a large industrial organization. Many of the UME-21 schools had more than one partner.

In many cases, formal written affiliations did not exist. The linkage between the medical school and the

partner often was based on personal relationships between the UME-21 leadership and individuals in management positions at the partner. This was especially the case when partner personnel came to the medical school to teach or students went to the partner for short-term experiences (for example, a field trip to a managed care organization).

Partners were used as sites of training and/or sources of expertise not readily available at the medical school. As training sites, students might have short experiences at the partner (for example, a site visit to a managed care organization or a public health clinic) or have longer-term exposure (for example, when partner facilities were used for ambulatory rotations). The partners supplied varied types of content expertise, including quality improvement, utilization review, cost effectiveness, and informatics. Some partners also supplied data for use in student projects.

There also was variation among the UME-21 schools in the degree to which partners participated in the planning and the management of the UME-21 program. At one end of the spectrum, key figures from the partners were actively involved, including membership on planning committees and regular communication with UME-21 personnel at the school. At the other end, the personnel from the partners were not directly involved in planning, and communication was more one-way from the school to the partner. The level of participation by partner personnel also changed during the course of the UME-21 program at some schools. Partnerships came under stress due to financial pressures in the partner organization, mergers or other organizational changes at the partner, or changes in job responsibilities of the individual at the partner organization who was central to the linkage.

Characteristics of the UME-21 Innovations

Although the UME-21 innovation involved a defined type of change, the site visits and progress reports from the schools revealed variation among the 18 schools in a variety of areas, including their experiences with similar innovations, the specific topics within the nine UME-21 content areas that were included, the placement of the content in the curriculum, and the instructional methods that were used. Schools also varied in whether they chose to highlight their UME-21 program as a distinct innovation or submerge it within existing or new curricular offerings.

The UME-21 content was reflected differently among the schools. Differences existed in the specific topics that were included, the depth to which the subjects were covered, the instructional methods that were used, and placement of the content in the curriculum. One major difference was between the partner schools, which were required to address all nine content areas, and the associate partners that focused on one or a small number of

the areas. Another difference was in the specific location of the content in the curriculum. Of the eight partner schools, five dispersed the content over multiple curriculum units and often over more than 1 year of the curriculum, while three concentrated the UME-21 innovation in a new or existing curriculum block. Schools also varied in how visible they chose to make the UME-21 innovation. For example, one school noted in the final report that “Very little announcement or identification was given to students that the nine key areas were special target subjects.” Some schools incorporated the UME-21 change into a concurrent curricular revision process.

According to the annual LCME questionnaire, the partner and associate partner schools had been covering many of the UME-21 topic areas in the curriculum prior to 1999. During the 1997–1998 academic year, all the schools reported addressing communication skills in a required course or clerkship. Ethics, evidence-based medicine, population-based medicine, and health

care systems also were included within required courses or clerkships in all 18 schools. Medical informatics was included within required courses in 16 of the 18 schools. There were no data from the questionnaire on the amount of time devoted to the subjects, on the location in the curriculum where these subjects appeared, or on the instructional formats used for teaching.

The analysis of the schools’ experiences over the 3-year period revealed that the impact of the UME-21 on the UME-21 content could best be understood by viewing the nine UME-21 content areas in two distinct clusters. One cluster involves new and emerging content areas, which have been specifically identified as important curricular components in the past few decades (“emerging” content areas).^{11,12} These new content areas include evidence-based medicine, quality measurement/improvement, health systems finance, medical informatics, and systems-based care. The second cluster comprises subjects, such as ethics, leadership skills/teamwork, patient communication, and prevention.

Table 1

Percentage of Seniors at UME-21 Schools and Other Schools in 1999–2001 Rating Instruction Adequate on AAMC GQ Items Within Clusters of UME-21 Content

	<i>UME-21 Partners</i>					<i>UME-21 Associate Partners</i>					<i>Other Schools</i>			
	1999	2000	2001	<i>Rate of Change</i>	<i>P Value</i>	1999	2000	2001	<i>Rate of Change</i>	<i>P Value</i>	1999	2000	2001	<i>Rate of Change</i>
<i>Emerging Content</i>														
Practice management	30	40	46	+53	.001	31	35	36	+18	.01*	28	33	34	+23
Managed care	47	58	55	+18	.001	49	54	53	+7	.001	39	42	39	0
Cost-effective medical practice	48	60	66	+37	.001	48	54	59	+24	.01	43	48	53	+21
Evidence-based medicine	80	83	92	+15	.001	79	84	88	+11	NS	78	81	86	+10
Quality assurance in medicine	48	60	64	+35	.01	45	53	64	+41	.001	43	49	56	+32
Computer-based patient records	78	86	88	+16	.001*	62	74	88	+40	.001	71	84	88	+23
<i>Traditional Content</i>														
Patient follow-up	50	59	62	+24	.05	62	60	72	+15	.001*	54	54	65	+20
Providing health education	68	67	65	-5	.001	65	59	59	-10	NS	57	61	52	-9
Health promotion and disease prevention	83	82	89	+7	NS	87	88	91	+5	NS	78	80	83	+6
Role of community health and social service agencies	62	61	67	+9	NS	72	73	73	+1	.001*	57	57	62	+8
Teamwork with other health professionals	85	83	84	-1	.001*	85	85	85	0	.001*	84	84	86	+2

Note: Rate of change is calculated as the difference between the value for 2001 and 1999, divided by the value for 1999. *P* values were determined using a 2-tailed binomial *z* test for proportions comparing the rate of change for the partner schools versus other schools and the associate partners versus other schools. It is important to note that on a few items identified by * the rate of change for the UME-21 schools was lower than other schools.

These topics, under a variety of rubrics, have appeared frequently in multiple calls for curricular reform in medical education from the early part of the 20th century ("traditional" content areas).^{13,14}

Seniors' Reports of UME-21 Content in the Curriculum

Table 1 shows the seniors' self-reports of the adequacy of instruction on 11 representative items from the AAMC GQ and the rates of change between 1999 and 2001 organized within the two clusters of emerging content and traditional content.

When making comparisons among these percentages, it is important to note that any difference of more than a few points is always statistically significant because of the large sample sizes involved. The percentages for the other schools (non-UME-21), which are based on more than 12,000 seniors per year, reflect the population of seniors in US medical schools. Therefore, it is more informative to concentrate on the magnitude of differences among the three groups of schools rather than the statistical significance.

Both the partner schools and associate partner schools were higher at baseline than the other US medical schools on every item except computer-based patient records, for which the associate partners were much

lower ($P < .001$) than other schools at baseline. Nevertheless, the rate of change from the baseline year of 1999 to the class of 2001 for the partner schools exceeded the rate of change for the other schools on every item except computer-based patient records. The greatest rate of change was observed in the items dealing with practice management, managed care, and cost-effective medical practice. For example, the percentage of seniors in 2001 rating instruction adequate in cost-effective practice was 66% in the partner schools and 59% in the associate partners but only 53% for the other schools. Similarly, the percentage of seniors rating instruction adequate in managed care rose to 55% in the partner schools and 53% in the associate partners but remained static at 39% for the other schools between 1999 and 2001.

However, the results were quite different when looking at the items representing traditional content. On nearly every item, the difference between the rate of change in the partner schools and associate partners as compared to the other schools was negligible. In fact, on the item related to providing health education to patients, each of the three groups of schools dropped during the period of UME-21. Only on the item related to patient follow-up was the rate of change for the UME-21 schools both positive and greater than at the other schools.

Table 2

Percentage of Seniors at UME-21 Schools and Other Schools Rating Instruction Adequate on Cost-effective Medical Practice Item from AAMC GQ

	School	Year of Graduation			Rate of Change
		1999	2000	2001	
<i>UME-21 partners</i>	A	54	58	64	+19
	B	29	33	43	+48*
	C	41	56	60	+46*
	D	46	89	85	+85*
	E	71	79	77	+8*
	F	44	47	76	+73*
	G	52	52	57	+10
	H	48	64	64	+33
<i>UME-21 associate partners</i>	I	67	49	57	-15
	J	34	51	67	+97*
	K	66	74	68	+3
	L	51	60	60	+18
	M	47	48	64	+36*
	N	43	38	50	+16
	O	39	48	60	+54*
	P	46	61	73	+59*
	Q	41	48	57	+39*
R	42	58	34	-19	
<i>Other medical schools</i>		43	48	53	+21

* The difference between the rate of change for these UME-21 schools and the rate of change for other medical schools is statistically significant ($P < .001$) using a 2-tailed binomial z test for proportions.

While Table 1 summarizes representative aggregate outcomes at the partner and associate partners schools taken collectively, there were conspicuous differences among the 18 schools on every item. For example, although ratings of the adequacy of instruction in evidence-based medicine were relatively high at the partner schools overall in 1999, in three schools, less than 70% of the seniors reported adequate instruction in evidence-based medicine in the baseline year. However, by 2001, more than 90% of seniors at these same three schools responded favorably.

One representative example of the variation seen across schools is students' ratings of instruction in cost-effective medical practice (Table 2). Although the average rates of change for the partner and associate partner schools reported in Table 1 are respectively 37% and 24%, Table 2 shows that the change from 1999 to 2001 ranged from -19% to +97% at the individual school level.

The seniors' self-reports of educational activities on the supplemental UME-21 Graduation Questionnaire also confirmed the variation in experiences at partner schools. Table 3 shows the fraction of seniors who reported that they either used an evidence-based medicine database during their medical education or assisted or observed someone doing so. Although there was a large and statistically significant ($P < .001$) overall rate of change over the period of the UME-21 project, there was wide variation among the schools reported by seniors at baseline and reported at the end of the project in 2001. In 2001, the percentage of seniors encountering the use of an evidence-based medicine database at three partner schools remained near or below 50%. The evaluation plan precluded the collection of comparable

data at the associate partner schools, and no national norms were available.

The analysis of the attitude items on the supplemental questionnaire showed little change in the attitudes of graduating seniors at the partner schools during the period of UME-21. For example, while 41% of seniors in 1999 agreed that good medical care is usually cost-effective care, the fraction agreeing in the class of 2001 dropped to 38%. Less than one third (32%) of seniors at the partner schools in 1999 agreed that the care of many chronically ill patients could be managed safely by certified nurse practitioners. In 2001, the rate of agreement rose slightly to 39% but ranged widely from a low of 25% in one school to 61% in another. In 1999, 47% of seniors agreed with a statement that quality of care cannot be measured objectively due to medical care complexity and patient variation. By 2001, the overall rate dropped to 45%. However, at the individual school level, this rate of agreement ranged from 30% to 68%. The pattern of agreement across all items was not consistently higher in any particular school or group of schools.

Discussion

The UME-21 project involved more than 3 years of sustained effort by administrators, faculty members, and external health system partners in a diverse group of 18 medical schools. The effort affected thousands of students in the graduating classes of 2001 and beyond.

The quantitative measures revealed that UME-21 was associated with significant change in multiple areas between the classes of 1999 and 2001. However, it is important to note that the innovations developed and implemented at many schools between 1998 and 2001 were directed at students in the preclinical curriculum during those 3 academic years. The majority of the students affected did not graduate until 2002 or beyond. Likewise, the final site visits at the partner schools in early 2001 and the review of the final reports submitted by all 18 schools in mid-2001 implied that many of these changes also had a measurable effect on many members of the graduating class of 2002 at these schools and that the UME-21 innovations were likely to be sustained in some form.

Limitations

The external evaluation of the partner schools began in the fall of 1998, 3 months after the UME-21 projects were already underway. Evaluation of the associate partners did not begin until 2001, more than 2 years later and very near the end of the UME-21 project. This meant that data about the baseline status at the institutions, especially related to prior inclusion of UME-21 content, could only be determined very generally (for example, through the LCME Annual Medical School Questionnaire). In some cases, this delay made it diffi-

Table 3

Percentage of Seniors at Eight UME-21 Partner Schools That Encountered Use of the Cochrane or Other Evidence-based Medicine Databases in Medical School

UME-21 School	Year of Graduation			Rate of Change
	1999	2000	2001	
A	52	51	65	25
B	68	71	92	35
C	18	30	39	117
D	40	59	63	55
E	57	81	97	40
F	20	43	51	31
G	6	31	54	800
H	37	65	78	111
Total, eight partner schools	37	52	64	73

cult to determine to what degree the UME-21 content in the curriculum at each school was new or represented a rearrangement of preexisting content among courses and clerkships. This delay also made it impossible to work with the 18 schools to develop and pretest a psychometrically sound instrument to measure students' attitudes toward controversial issues in the health care environment and to collect baseline data across all schools.

The UME-21 innovation mandated change that included both content (the nine UME-21 areas) and process (collaboration among the generalist disciplines and with one or more external partners) components. Within these guidelines, each of the partner schools had freedom to design a program that met its specific goals and circumstances. In addition, while the eight partner schools were expected to develop a comprehensive program that incorporated all the nine content areas, the associate partner schools implemented specific interventions. As a result, there was significant variation among the 18 schools in the content included in the UME-21 program. As noted, there also was variation in the implementation schedules, affecting different cohorts of medical students across the schools, and in the schools' baseline curricular status (that is, how much content related to UME-21 already existed in the curriculum). All this variation makes it difficult to compare results across schools and also makes it difficult to isolate the unique effects of UME-21.

Since the national evaluation aimed to assess outcomes across the institutions, the outcome indicators used had to be sufficiently general to apply. The evaluation design could not include a standardized test of knowledge, due to timing issues and the diverse objectives among the programs. Therefore, a set of indicators was chosen that included students' self-reports of the adequacy of their instruction, their actual learning experiences, and their attitudes. Such an evaluation could not focus specifically on the UME-21 segment of the curriculum, but captured information related to the curriculum as a whole. The hypothesis was that students at the UME-21 schools would, on average, report greater awareness of and exposure to these areas.

When assessing the impact of the UME-21 program, it is important to keep in mind the relatively low level of external financial support provided. Partner schools received \$125,000 annually for 3 years, and associate partner schools received just \$20,000 per year. Based on recent estimates of the real cost of medical education,¹⁵ these awards represented increments to each schools' education budget of less than .5% for the partner schools and less than .1% for the associates. In the site visits and reports, a number of schools reported that UME-21 had been "catalytic." Change could not have occurred without the stimulus of external funding, which gave the innovation credibility. The exist-

ence of funding, rather than the absolute amount, had given the curriculum change legitimacy in the eyes of medical school administrators, other faculty members, and external partners.

Effect of the UME-21 Program

Despite these limitations, evaluation of the UME-21 program revealed changes in students' ratings of instruction, especially in newer areas of evidence-based medicine, quality assurance, and cost-effectiveness in relation to national norms. Changes in other content areas (for example, ethics and prevention) were less marked. And, there was considerable variation in the degree to which some curricular areas were perceived by students as being covered in the curriculum.

What could account for the difference, in aggregate, between the results for the emerging content areas and the traditional areas? It may be that the emerging areas became differentially more visible to students due to UME-21, in that they were more specific and lent themselves better to defined learning activities. Also, the percentage of students rating instruction in the traditional areas as adequate before UME-21 was, in general, higher than in the emerging areas (see Table 1). Therefore, large gains would not be expected when the baseline rates were already high.

Conclusions

The evaluation of a project as complex as UME-21 involves methodological constraints. Quantitative outcome measures must be chosen to represent a "least common denominator," in that they must apply to all schools. It is only in combining the global quantitative and qualitative indicators that were used in the national evaluation with the specific evaluations that were carried out at the individual schools, that a true picture of the effects of the UME-21 program will emerge. To ensure comprehensive and useful evaluation results, similar national programs aimed at sweeping curricular change that are carried out in the future should have the following characteristics: (1) evaluation should be built into initial project planning, (2) project funding timelines should reflect the need to collect outcome data, and (3) funding should be provided for collaborative development of evaluation instruments that can be used across institutions.

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