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Running Title: Curricular Effect on Students' Geriatrics Knowledge

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ABSTRACT

BACKGROUND: Medical schools across the nation have turned attention to strengthening their curricula in geriatric medicine to prepare students for an aging nation. Effects of enhanced curricula need to be evaluated for program monitoring and continuous improvement.

OBJECTIVE: To evaluate the effect of an enhanced geriatrics curriculum on medical students' knowledge.

DESIGN: Longitudinal cohort studies with cross-sectional historical comparisons.

PARTICIPANTS: The Class of 2005 students (n = 150) and a random sample of the Class of 2001 students (n = 43) as a historical control with the control group received a lesser amount of geriatrics training.

MEASUREMENTS: A validated 18-item geriatrics knowledge test assessing medical students' knowledge about aging (6 items) and clinical geriatric management (12 items) was administered to the Class of 2005 students at the baseline and end of years 1, 2, and 3, and to the Class of 2001 students at the end of year 4.

RESULTS: The Class of 2005 students demonstrated a significant increase in the number of items answered correctly (M = 35% to M = 75%, $p < .001$) and a significant decrease in the number of items answered "Don't Know" (M = 44% to M = 5%, $p < .001$). The cohort also showed a better performance at the end of year 3 (M = 75%) than the fourth-year control group (M = 71%, $p = .009$).

CONCLUSIONS: The enhanced geriatrics curriculum demonstrated an effect on improving medical students' geriatrics knowledge.

Number of Words: 239

KEY WORDS: geriatrics knowledge assessment, geriatric education, program evaluation

INTRODUCTION

As the United States' population over 65 has continued to grow, medical schools have turned their attention to strengthening curricula in geriatric medicine. The United States Census Bureau has predicted that the 65 year-and-older population will grow about 3 1/2 times faster than the nation as a whole over the next 25 years, reaching 20% of the total population by 2030. It has already been documented that patients in this age group have more than twice as many contacts with physicians as younger persons and account for almost half of all days of hospital care.[1] This disproportionate share of health care utilization will increase dramatically as the elderly population increases. The physicians who will provide care for these elderly persons are beginning to be trained now. Despite increased enrollment in geriatrics fellowship programs,[2] physicians in all specialties will need a basic understanding of how to care for older adults.[3,4] Since the publication of Core Competencies for the Care of Older Patients by the Education Committee Working Group of the American Geriatrics Society[5] in 2000 and increased funding opportunities for geriatric education, many medical schools[6] have turned their attention to the improvement of geriatric education. Numerous innovations have been implemented including an integrated 4-year curriculum,[7] a mandatory geriatrics clerkship,[8-10] a pre-clinical senior mentoring program,[11-12] a concentration on didactic and bedside teaching,[13-15] an integration of geriatric education with other specialty clerkships,[16] a geriatric interdisciplinary team training program,[17] and web-based learning modules.[18] These interventions have demonstrated positive effects on knowledge, attitudes, and skills in geriatric patient care. The *AAMC Graduation Questionnaire* completed by senior medical students each year reflects the impact of this nationwide emphasis on geriatrics in the results of the graduating class of 2004, in which the percent reporting inadequate

amounts of geriatric education fell below 30% for the first time since the term "geriatrics" was added.[19]

In 1999, stimulated by the passage of a bill by the California state legislature requiring increased geriatric education for health care providers and students and supported by funding from several foundations and agencies, the David Geffen School of Medicine at UCLA, well known for its fellowship training in geriatrics, turned its focus to medical student education. A survey of the existing student curriculum revealed 25 hours of lectures and case discussions, all of it in the two preclinical years. By 2001, UCLA had implemented an enhanced geriatrics curriculum, adding 36 new hours of problem-based cases, lectures, and multi-media tools for first, second, and third-year students[20] (see Table 1).

The purpose of this study is to evaluate the effect of this enhanced geriatrics curriculum on students' knowledge about aging and clinical geriatric management, following one cohort of students from the beginning to the end of the required curriculum.

METHODS

Participants

We followed the cohort of 150 medical students in the graduating Class of 2005 from entry in 2001 to the end of their third year in 2004 using a repeated measures design. The first assessment was administered in October, 2001, before students had any formal exposure to geriatrics (baseline), and then again at the end of the first, second, and third year curricula. Over the three-year period, the cohort experienced 61 hours of structured education in geriatrics, 36 of which were new curricular components.

We also administered the same assessment to a random sample (n = 50) of senior medical students (graduating Class of 2001) in March, 2001, as a historical control. These students had not been

exposed to an enriched geriatrics curriculum, although they had received 25 hours of existing geriatrics content. Control participants received a $50 gift certificate.

The UCLA Internal Review Board approved this study. Students' participation was voluntary.

Measurement

An 18-item test to assess medical students' knowledge about aging (6 items) and clinical geriatric management (12 items) had been previously developed and validated by the authors.[21] The test demonstrated sound internal consistency as well as concurrent and known-group validity in both initial and cross-validation studies. The test included a "Don't Know" response option to discourage guessing. This geriatrics exam was administered four times to the intervention group with no feedback or scoring information provided in between.

Data Analysis

We used raw scores and percentages for each of the answer types (correct, incorrect and "Don't Know") and the two content domains (aging facts and clinical geriatric management) in multivariate analyses of variance (MANOVAs) across years followed by univariate ANOVAs and post hoc t-tests with Bonferroni corrections for multiple comparisons to examine significant MANOVA results. To compare change across years within individual students, we conducted repeated measures analyses of variance for the subset of students who completed the test all four times. A Student t-test was calculated to ensure that there was no difference in the mean percent correct score at the baseline between those students who completed all four tests and those who did not.

To further evaluate the effect of the newly implemented geriatrics curriculum, we used multivariate analyses of variance (MANOVAs) to compare the scores of the Class of 2005 students at the end of year three and the scores of seniors in the Class of 2001, followed by univariate

ANOVAs.

All statistical analyses were performed using the SPSS system version 14.0, and $p \leq .05$ was considered statistically significant.

RESULTS

The participation rates during the four administrations for the Class of 2005 ranged from 91% at baseline (n = 137) to 80% at the end of year three (n = 145). The year three cohort included 24 students from the University of California, Riverside, Biomedical Sciences Program who completed the first two years off campus but with a similar curriculum. Only 55% (n = 69) of the 125 students remaining in the cohort across all three years completed the four surveys. The participation rate for the Class of 2001 students was 86% (n = 43).

The Class of 2005 demonstrated a significant increase in knowledge across years ($F = 60.13$, df = 9,1324, $p < .001$) with a significant increase in the number of items answered correctly ($F = 232.64$, df = 3, 546, $p < .001$) and a significant decrease in the number of items answered "Don't Know" ($F = 141.2$, df = 3,546, $p < .001$) (Table 2). By the end of their core curriculum in geriatrics, the mean percent correct rose from 35% (6 items) to 75% (13 items) with those selecting the "Don't Know" option decreasing from 44% (8 items) to 5% (1 item). The number of items answered incorrectly, however, did not change significantly over the three years, with 21% at baseline and 20% at the end of the third year.

The cohort demonstrated a significant change in both knowledge domains ($F = 103.51$, df = 6,1088, $p < .001$) with a significant increase in the scores for both the aging facts items ($F = 37.32$, df = 3,545, $p < .001$) and the clinical management items ($F = 254.25$, df = 3,545, $p < .001$). The increase was more prominent in the domain of clinical management (27 % to 75%) than in aging facts (50% to 74%). The greatest increase in percent correct occurred between the end of year one

and the end of year two of medical school for both clinical management and aging facts domains ($t = 13.69$, $p < .001$; $t = 5.15$, $p < .001$, respectively).

The pattern of changes for the 69 students who completed all four assessments was similar to that of the larger cohort. Students' percent correct scores at baseline for the 69 who completed all four surveys ($M = 35\%$, $SD = 15\%$) were not significantly ($t = .40$, $p = .69$) different from those of the 56 eligible students who did not complete all four surveys ($M = 36\%$, $SD = 17\%$).

At the end of their third year, the Class of 2005 scored significantly higher than the Class of 2001 students at the end of their fourth year who had received a lesser amount of geriatrics training ($F = 3.96$, $df = 3,184$, $p = .009$). Scores were higher for correct answers ($M = 75\%$ vs. 71%, $F = 5.06$, $df = 1,186$, $p = .03$) and lower in the use of "Don't Know" answers ($M = 5\%$ vs. 9%, $F = 10.9$, $df = 1,186$, $p = .001$). The two groups, however, did not differ significantly in the number of incorrect answers ($M = 20\%$ vs. 20.03%, $F < 0.001$, $p = .99$). When compared on the two knowledge domains, the Class of 2005 students' mean percent correct score for aging facts ($M = 74\%$, $SD = 20\%$) was significantly ($F = 6.56$, $df = 1,186$, $p = .01$) higher than that of the Class of 2001 students ($M = 65\%$, $SD = 22\%$), but the two groups did not differ significantly ($F = 0.53$, $df = 1, 186$, $p = .47$) on clinical management ($M = 75\%$, $SD = 13\%$ vs. $M = 73\%$, $SD = 12\%$).

DISCUSSION

As would be hoped, increasing the amount of curricular time on geriatrics was associated with increasing knowledge of both aging facts and clinical management. Of particular interest is that after only three years of curriculum, the intervention group demonstrated higher knowledge of facts about aging than did a comparison group who had completed four years of medical school but with less focused attention on geriatrics.

Although one of the primary features of the enhanced geriatrics curriculum was its extension into

the core clerkships during year three, the intervention cohort demonstrated a greater growth in knowledge as a result of the second year curriculum (26 hours) than of the first year (25 hours) or third year (10 hours). This difference between curricular effects of years one and two may be the result of the use of a greater range of instructional modalities in year two, including lectures, problem-based learning, standardized patient exercises, computer-assisted instruction, and even a site visit to a nursing home for hands-on practice of clinical assessment skills. The limited year-three effect may be purely due to fewer contact hours or the lack of didactic power in the face of the exciting world of hands-on clinical medicine.

Somewhat surprising was the pattern in students' use of the answer options. As the percent correct increased, the percent of "Don't Know" answers decreased. However, the percent of incorrect answers remained the same. An analysis of the content of these incorrect items suggested a persistent lack of knowledge in the areas of nutrition, normal physiologic changes, and nursing home care. For example, only 50% of the total cohort in year three was able to label the following statement as false: "Memory loss is a normal part of aging." It may be necessary to develop teaching methods that more rigorously attempt to "debug" commonly held misconceptions rather than merely add new concepts.

There are a number of limitations to our findings beyond its restriction to a single medical school. First, only 55% of the intervention cohort completed all four tests limiting our ability to track change across identical groups each year. However, the baseline scores of this group of students did not significantly differ from those of the entire cohort. Second, although the Class of 2001 students were involved in the study as historical controls, they were surveyed nine months later than the final assessment of the experimental cohort. This time difference might have obscured actual differences between the two cohorts. Lastly, it is possible that the use of a repeated

measures design for the Class of 2005 may have accounted for the demonstrated knowledge growth rather than the curriculum itself. However, students never saw their scored exams after any of the measurements and the same items remained largely incorrect over time.

CONCLUSION

In summary, both the longitudinal and cross-sectional examinations conducted in the study showed curricular effects of an enhanced geriatrics curriculum. The study also demonstrated that the knowledge test used in the investigation provides a reliable benchmark against which geriatrics curricular effects can be measured. Students' weaknesses revealed through repeated testing can also be used to target areas of knowledge resistant to more common instructional methods. To provide stronger evidence that a curriculum produces a desired effect, future studies should be strengthened by employing a more comparable control group and multi-institutional comparisons.

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Table 1. Geriatrics Curriculum at UCLA Medical School

Enhanced Geriatrics Curriculum (Total Hours: 36, Received by the Class of 2005 Students)

Year	Format	Topic	Total ours
1	PBL* with Video Case Discussion	Osteoporosis	4
1	PBL*	Congestive Heart Failure	4
1	PBL*	Dyspnea	4
1	Lecture and Patient Visit to Class	Organ Effects	2
2	Lecture	Cellular Aging	2
2	Lecture with Video Case Discussion	Alzheimers	1
2	Computer Cases	Polypharmacy	1
2	PBL*	Colon CA	4
2	PBL*	Hypothyroidism	4
3	Write Up	Geriatric Assessment	1
3	Audience Response System Game	Facts on Aging Jeopardy	1
3	Computer-based Module	Gait & Balance	1
3	Lecture	Incontinence	1
3	Case Discussion	Pain Management	1
3	Case Discussion	End of Life Care	1.5
3	Lecture	Palliative Care	1.5
3	SP† Case Discussion	Dementia	2

Existing Geriatrics Curriculum (Total Hours: 25, Received by both Classes of 2001 and 2005 Students)

Year	Format	Topic	Total Hours
1	SP[†] & Video Case Discussion	Community Resources; Activities of Daily Living	6
1	Video Case Discussion	Death & Dying	1
1	PBL[*]	Complications of Hypertension and Treatment	4
2	Lecture	Geriatric Assessment	2
2	Nursing Home Visit	Clinical Skills	3
2	Lecture	Dementia	2
2	Case Discussion	Dementia	2
2	Lecture	Diseases common in older persons	1
2	SP[†] & Video Case Discussion	Pancreatic Cancer/End of Life Care	4

[*] PBL stands for problem-based learning.

[†] SP stands for standardized patient.

Table 2. Comparison of Class of 2005 Answers to Geriatrics Knowledge Test across Years[*]

	Correct Answer				"Don't Know" Answer				Incorrect Answer			
	Raw Score[†]		Percent Score		Raw Score[†]		Percent Score		Raw Score[†]		Percent Score	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Baseline (n=137)	6.29	2.76	35	15	7.95	4.05	44	22	3.72	2.22	21	12
End of Year 1 (n=129)	7.13	3.10	40	17	6.89	4.23	38	23	3.88	2.43	22	13
End of Year 2 (n=139)	11.32	2.73	63	15	3.12	2.75	17	15	3.50	2.01	19	11
End of Year 3 (n=145)	13.47	1.89	75	10	0.92	1.23	5	7	3.60	1.79	20	10
p-value[‡]	< .001				< .001				.49			

[*] A multivariate analysis of variance (MANOVA) showed an overall significant ($F = 60.13$, $df = 9,1324$, $p < .001$) change in answers to the knowledge test across years.

[†] The possible range of the raw scores for each answer category was 0 – 18.

[‡] The p values reported were based on a univariate analysis of variance (ANOVA) within each answer category.