

## Special Article

# Senior Medical Students' Knowledge of and Attitudes Toward Anesthesiology in Ten Medical Schools

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THE American Society of Anesthesiologists has sponsored a national preceptorship program in anesthesiology for medical students since 1966. The purpose of the program is to enhance students' understanding of and interest in anesthesiology. An evaluation of the effectiveness of the first five years of the program has been completed.<sup>1</sup> This assessment was limited to students and preceptors who participated in the program. Of further importance, however, is whether students who have participated and those who have not participated in the program differ with respect to knowledge, skills, and attitudes. In order to add this dimension to the evaluation of the program, a survey of senior medical students in ten medical schools in the United States was conducted in 1971.

Three major hypotheses were tested: 1) significantly more of the senior medical students who have participated in the program would respond correctly to a series of questions over basic knowledge areas of anesthesiology than would senior medical students who have not participated in the program; 2) significantly more of the senior medical students who have participated in the program would consider themselves more skilled in these knowledge areas than would senior medical students who have not participated in the program; 3) significantly more of the senior medical students who have participated in the program would

have positive attitudes toward the specialty and consider it as a specialty choice than would senior medical students who have not participated in the program.

### Methods

A questionnaire was designed by members of the Medical Student Preceptorship Committee of the American Society of Anesthesiologists (ASA) and the senior author. The questionnaire was composed of a series of brief clinical situations which required students to select the action they would take in the situation from a list of alternatives. The situations elicited student's knowledge of endotracheal intubation, lumbar puncture, regional anesthesia, management of shock, positive-pressure ventilation and pharmacologic interaction. Students were also asked to indicate the adequacy (very adequate, adequate, not adequate) of their skill in dealing with each type of clinical situation. In addition, students were asked to indicate the primary source (department and service) of their knowledge and skill regarding the situation.

Additional questions were asked regarding changes in students' attitudes toward anesthesiology during medical school, major factors that influenced their attitude toward the specialty, and their interest in the specialty as a career choice.

The ten medical schools were selected to ensure regional representation, and all were schools which had contributed students to the program. The senior class president in each school was contacted by the ASA to elicit his cooperation in assembling his class to take the survey and a reward was offered to those senior classes which achieved the highest percentage

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TABLE 1. Responses of Senior Medical Students to Survey, by Medical School

Medical School	Number of Seniors Who Were Not Preceptees	Number of Seniors Who Were Former Preceptees	Per Cent Preceptee Response	Per Cent of Total Response
George Washington	97	8	63	83
Jefferson	152	8	63	79
Southwestern	87	18	100	78
Wisconsin (Marquette)	67	13	62	74
Harvard	147	3	67	61
Loma Linda	95	5	60	60
Women's Medical College of Philadelphia	43	7	43	58
UCLA	99	1	100	53
New York-Dowstate	138	11	64	36
Northwestern	161	4	75	33
TOTAL	1,086	78	(Mean 71)	(Mean 60)

of participation. The senior class was selected because it was thought that the graduating class would have had more of a chance to participate in whatever anesthesia experience had been offered at the school; however, since few of the senior classes meet as a group, the stipend was offered to assure their participation. A representative of the Department of Anesthesiology coordinated the survey at each school. The purpose of the survey, namely to compare students who had and had not participated in the national preceptorship program, was not known to the students. To enable comparisons to be made between these two groups of students, however, students were asked to sign their names to the questionnaires so that former preceptees could be identified from a master roster. Table 1 lists the medical schools participating in the survey and the student response by school. Six-hundred and ninety-eight, or 60 per cent, of the senior medical students in the ten schools responded. Fifty-five, or 71 per cent, of those seniors who had participated in the preceptorship program returned questionnaires. The remaining 643 seniors had not participated in the program.

### Results

Table 2 presents data relevant to the first hypothesis. The incorrect responses to each of the knowledge questions were combined and compared with the correct response in a Chi-square analysis of each question. There were no statistically significant differences between

students who had and had not participated in the preceptorship program in their correct responses to the six knowledge areas over which they were questioned. As a total group more students gave correct answers to the questions dealing with shock and lumbar puncture (91 and 96 per cent, respectively). As a total group students performed next best on the questions about pharmacologic interaction (63 per cent gave correct answers) and endotracheal intubation (44 per cent gave correct answers). Student performance was poorest on the two questions dealing with regional anesthesia (19 and 33 per cent answered correctly) and the question on positive-pressure ventilation (22 per cent answered correctly).

Table 3 shows the data pertinent to the second hypothesis. Significantly more students who had participated in the preceptorship program than students who had not taken a preceptorship considered their skills in endotracheal intubation and positive-pressure ventilation more adequate. There were no significant differences between the two groups of students regarding their assessment of skills in lumbar puncture, regional anesthesia, the management of shock, and pharmacologic interaction. It is noteworthy that three fourths of both groups of students regarded their skills in regional anesthesia as inadequate and one third of both groups regarded their skills in positive-pressure ventilation as inadequate. These were also the two areas the students performed poorly on in the knowledge section. It should be pointed

TABLE 2. Students in the Program and Students Not in the Program, by Responses in Knowledge Areas of Anesthesiology\*

Knowledge Area	Students in Program		Students Not in Program		Significance
	Number	Per Cent	Number	Per Cent	
<b>1. Endotracheal intubation</b> A patient with severe emphysema becomes cyanotic after morphine. Oxygen is administered by face mask. The patient becomes apneic. The best therapy is: a) discontinue oxygen b) administer carbon dioxide c) insert an endotracheal tube †d) administer oxygen with positive-pressure ventilation	5 2 19 29	9 4 35 53	111 46 202 274	17 7 32 43	NS
<b>2. Lumbar puncture</b> An anesthesiologist usually uses the smallest-needle possible for lumbar puncture. This is done to avoid: a) puncture of the spinal cord b) puncture of the dura c) puncture of the nerve root †d) postlumbar-puncture headache	1 1 2 50	2 2 4 91	9 6 45 577	1 1 7 90	NS
<b>3. Regional anesthesia</b> <b>Finger laceration</b> A. A finger block is done with local anesthetic. You would choose which of the following available agents: a) $\frac{1}{2}\%$ lidocaine with 1:200,000 epinephrine †b) $\frac{1}{2}\%$ lidocaine without epinephrine c) 1% lidocaine with epinephrine d) 2% lidocaine without epinephrine e) 4% lidocaine without epinephrine B. Same abrasion of the hand, requiring debridement and cleaning. An axillary block seems indicated. Which of the following agents would you choose? a) $\frac{1}{2}\%$ lidocaine with 1:200,000 epinephrine b) $\frac{1}{2}\%$ lidocaine without epinephrine †c) 1% lidocaine with epinephrine d) 2% lidocaine without epinephrine e) 4% lidocaine without epinephrine	3 10 7 34 1	5 18 13 62 2	27 120 140 345 3	4 19 22 54 0.5	NS
<b>4. Shock</b> If a patient in shock is found to have a lowered central venous pressure, arterial blood pressure and urinary output, the first treatment that should be instituted is: a) alpha-adrenergic blocking agent b) alpha-adrenergic stimulating agent c) beta-adrenergic blocking agent †d) rapid administration of fluids intravenously	— 2 — 53	— 4 — 96	2 18 3 615	0.3 3 0.5 96	NS

TABLE 2. (Continued)

Knowledge Area	Students in Program		Students Not in Program		Significance
	Number	Per Cent	Number	Per Cent	
5. Positive-pressure ventilation In initiating cardiopulmonary resuscitation as a single rescuer, do you:					
a) ventilate 10 X, heart compression 10 X	—	—	4	0.6	NS
‡b) ventilate 3 X, heart compression 15 X	17	31	134	21	
c) ventilate 1 X, heart compression 5 X	27	49	395	62	
d) ventilate 2 X, heart compression 10 X	10	18	99	15	
6. Pharmacologic interaction A hypertensive patient on diuretics and rauwolfia alkaloids is presented for a hysterectomy. Which single laboratory test might warn of problems under anesthesia?					
‡a) blood potassium	36	65	392	61	NS
b) blood sodium	1	2	26	4	
c) urinary VMA	12	22	121	19	
d) blood volume	6	11	94	15	

\* Unknown responses were excluded from analysis; hence total responses do not always add to N = 698.

† NS = not statistically significant at 0.05 level.

‡ Indicates correct answer to question.

TABLE 3. Students in the Program and Not in the Program by Level of Skill Regarding Selected Clinical Procedures

How do you consider your skills in*:		Students in Program		Students Not in Program		Significance
		Number	Per Cent	Number	Per Cent	
Endotracheal intubation	Very adequate	18	33	31	5	$\chi^2 = 68.87$ ; 2df; $P \leq 0.001$
	Adequate	29	53	302	47	
	Not adequate	8	15	308	48	
Lumbar puncture	Very adequate	21	38	182	28	NS
	Adequate	32	58	389	61	
	Not adequate	1	2	48	11	
Regional anesthesia	Very adequate	1	2	10	2	NS
	Adequate	12	22	100	16	
	Not adequate	42	76	526	82	
Managing shock	Very adequate	7	13	72	11	NS
	Adequate	36	65	437	68	
	No adequate	11	20	128	20	
Positive-pressure ventilation	Very adequate	10	18	41	6	$\chi^2 = 11.37$ ; 2df; $P \leq 0.01$
	Adequate	27	49	327	51	
	Not adequate	17	31	271	42	
Pharmacologic interaction	Very adequate	5	9	56	9	NS
	Adequate	35	64	381	59	
	Not adequate	15	27	200	31	

\* Unknown responses were excluded from analysis; hence totals do not always add to N = 698.

TABLE 4. Students in the Program and Not in the Program by Source of Primary Knowledge Regarding Selected Clinical Procedures

Where did you obtain your primary knowledge regarding:		Students in Program		Students Not in Program	
		Number	Per Cent	Number	Per Cent
Endotracheal intubation	Anesthesiology	—	—	266	41
	Rotation	1	2	45	7
	Elective	—	—	—	—
	Preceptorship	46	84	19	3
	Surgery	—	—	56	9
	Rotation	—	—	4	0.6
	Elective	—	—	1	0.1
	Preceptorship	—	—	—	—
	Internal medicine	—	—	—	—
	Rotation	6	11	143	22
	Elective	—	—	10	2
	Preceptorship	—	—	1	0.1
	Pharmacology	—	—	21	3
Other rotation	1	2	44	7	
Lumbar puncture	Anesthesiology	—	—	—	—
	Rotation	1	2	48	7
	Elective	1	2	17	3
	Preceptorship	31	56	16	3
	Surgery	—	—	—	—
	Rotation	—	—	19	3
	Elective	—	—	3	0.005
	Preceptorship	—	—	—	—
	Internal medicine	—	—	—	—
	Rotation	20	36	415	65
	Elective	—	—	19	3
	Preceptorship	—	—	4	0.006
	Other rotation	2	4	92	14
Regional anesthesia	Anesthesiology	—	—	207	32
	Rotation	1	2	22	5
	Elective	—	—	—	—
	Preceptorship	30	55	14	2
	Surgery	—	—	—	—
	Rotation	12	22	205	32
	Elective	—	—	16	2
	Preceptorship	—	—	1	0.001
	Internal medicine	—	—	—	—
	Rotation	1	2	12	2
	Elective	—	—	2	0.003
	Preceptorship	—	—	1	0.001
	Pharmacology	5	9	36	6
Other rotation	5	9	53	8	
Managing shock	Anesthesiology	—	—	11	2
	Rotation	—	—	—	—
	Elective	2	4	10	2
	Preceptorship	7	13	4	0.006
	Surgery	—	—	—	—
	Rotation	25	45	261	41
	Elective	1	2	12	2
	Preceptorship	—	—	3	0.004
	Internal medicine	—	—	—	—
	Rotation	14	25	262	41
	Elective	1	2	21	3
	Preceptorship	—	—	1	0.001
	Pharmacology	—	—	14	2
Other rotation	4	7	21	3	

TABLE 4.—(Continued)

Where did you obtain your primary knowledge regarding:		Students in Program		Students Not in Program	
		Number	Per Cent	Number	Per Cent
Positive-pressure ventilation	Anesthesiology				
	Rotation	3	5	232	36
	Elective	5	9	44	7
	Preceptorship	28	51	20	3
	Surgery				
	Rotation	2	4	73	11
	Elective	1	2	7	1
	Preceptorship	—	—	3	0.004
	Internal medicine				
	Rotation	13	25	170	26
Elective	—	—	19	3	
Preceptorship	—	—	1	0.001	
Other rotation	—	—	39	6	
Pharmacologic interaction	Anesthesiology				
	Rotation	2	4	37	6
	Elective	—	—	4	0.006
	Preceptorship	5	9	4	0.006
	Surgery				
	Rotation	2	4	26	4
	Elective	—	—	—	—
	Preceptorship	—	—	—	—
	Internal medicine				
	Rotation	14	25	218	34
	Elective	1	2	10	2
	Preceptorship	—	—	1	0.001
	Pharmacology	31	56	290	45
Other rotation	—	—	12	2	

\* Unknown responses were excluded; hence totals do not always add to  $N = 698$ .

out, however, that because this was a national survey it was impossible to obtain an assessment of students' clinical skills other than their own. In addition, the inadequacy of skills in regional anesthesia is undoubtedly attributable to the guidelines provided to preceptors instructing them not to allow students to perform spinal anesthesia or regional blocks.

Table 4 shows the departments and services where students said they obtained their primary knowledge of endotracheal intubation, lumbar puncture, regional anesthesia, the management of shock, positive-pressure ventilation, and pharmacologic interaction. Regarding endotracheal intubation, the majority of students in the preceptorship program said that they obtained this knowledge during that experience, while the majority of students not in the program gained their knowledge of endotracheal intubation during their anesthesiology or internal medicine rotations. Students in the preceptorship program gained their knowledge of lumbar puncture during the preceptorship

or during internal medicine rotations; the majority of students not in the preceptorship program indicated the internal medicine rotation as their source of knowledge regarding lumbar puncture. The majority of students in the preceptorship program indicated the preceptorship or surgery rotation as their source of knowledge about regional anesthesia, while most students not in the program obtained this knowledge during rotations in anesthesiology or surgery. Students in the preceptorship program obtained their knowledge about the management of shock primarily from their internal medicine or surgery rotations, as did the majority of students not in the preceptorship program. Students in the preceptorship program learned about positive-pressure ventilation during this experience or during their internal medicine rotation, while most students not in the program learned this knowledge during their rotations in anesthesiology or internal medicine. Regarding pharmacologic interaction, most students in the preceptorship program and stu-

TABLE 5. Students in the Program and Not in the Program by Attitude Change  
Toward Anesthesiology and Source of Attitudes

		Students in Program		Students Not in Program		Significance
		Number	Per Cent	Number	Per Cent	
Forgetting about career choice, in general are your ideas about anesthesiology different now from what they were in your early years in medical school?	More positive now	40	73	399	62	NS
	Still positive	6	11	83	13	
	More negative now	6	11	90	14	
	Still negative	3	5	61	10	
What prime factor influenced your attitude toward anesthesiology as a field?	Routine exposure to anesthesiology	—	—	316	49	*
	Routine exposure to surgery	1	2	83	13	
	Anesthesiology elective	3	5	88	14	
	Surgery elective	—	—	18	3	
	Anesthesiology preceptorship	50	91	—	—	
	Exposure to a specific anesthesiologist	—	—	96	15	
	Other	1	2	24	4	

\* Unknown responses are excluded. The small numbers for some categories of this question did not permit statistical analysis.

dents not in the program learned this information from pharmacology or during their rotation in internal medicine.

Table 5 shows data relevant to the third hypothesis. There was no statistically significant difference between the attitudes of the two groups of students toward anesthesiology; 73 per cent of the seniors who had taken a preceptorship said that their attitudes toward anesthesiology were more positive now than they had been in the early years of medical school; 62 per cent of the seniors who had not participated in the program admitted to more positive attitudes toward the specialty as seniors than as preclinical students. Table 5 also points out that 91 per cent of the seniors who had participated in the program cited the preceptorship as a major factor in influencing their attitude toward anesthesiology, while students who had not participated in the program derived their attitudes toward anesthesiology from several sources: routine exposure to anesthesiology (49 per cent), routine exposure to surgery (13 per cent), anesthesiology elective (14 per cent), surgery elective (3 per cent), exposure to a specific anesthesiologist (15 per cent), and other (4 per cent).

Students' attitudes toward anesthesiology and the major factor influencing their attitudes differed by medical school, as shown in table 6. Greater percentages of students from Schools 6 and 7 had more negative attitudes toward anesthesiology as seniors (34 and 41 per cent, respectively) than did students in the other eight schools. It is noteworthy that 24 per cent of the seniors in School 6 were in the preceptorship program and an additional 21 per cent cited exposure to a specific anesthesiologist as a prime factor in influencing their attitudes toward the specialty. In School 7, on the other hand, students' exposure to anesthesiology was primarily routine (66 per cent). It is noteworthy that while Schools 7 and 8 both had the highest percentages of students with routine exposure to anesthesiologists, the attitudes of more of the seniors in School 7 were negative toward the specialty.

Table 7 provides additional insight into the above differences in students' attitudes among schools. Again, it is noted that greater percentages of students in Schools 6 and 7 said that their clinical experience in anesthesiology unfavorably influenced their attitudes toward the specialty (55 and 57 per cent, respec-

TABLE 6. Student Response by Medical School and Attitudes Toward Anesthesiology

	Per Cent Response by Medical School									
	School 1	School 2	School 3	School 4	School 5	School 6	School 7	School 8	School 9	School 10
Forgetting about career choice, in general are your ideas about anesthesiology different now than they were in your early years in medical school?*	77	67	67	64	66	55	40	60	48	64
More positive now	9	17	15	19	9	7	2	15	20	11
Still positive	6	9	11	8	8	34	41	18	15	15
More negative now	5	6	7	8	15	3	15	7	17	9
Still negative										
What prime factor has influenced your attitude toward anesthesiology as a field?*	51	31	32	46	52	34	66	73	17	62
Routine exposure to anesthesiology										
Routine exposure to surgery	2	12	12	14	21	7	9	7	30	5
Anesthesiology elective	3	9	22	3	8	10	6	3	15	5
Surgery elective	—	2	1	3	4	—	4	—	6	7
Anesthesiology preceptorship	8	13	23	19	2	24	4	5	17	7
Exposure to specific anesthesiologist	23	25	9	10	10	21	8	8	6	7
Other	8	6	—	3	2	3	4	—	4	4

\* Unknown responses are excluded from analysis. The numerical listing of schools in this table does not correspond to the unnumbered list shown in table 1.

TABLE 7. Student Response by Medical School and Effect of Clinical Experience Attitudes Toward Anesthesiology

	Per Cent Response by Medical School									
	School 1	School 2	School 3	School 4	School 5	School 6	School 7	School 8	School 9	School 10
In what way did your clinical experience in anesthesiology affect your attitudes toward anesthesiology?	62	44	62	49	49	11	20	62	44	44
Favorable	23	28	26	35	42	55	57	23	33	34
Unfavorable	15	17	12	15	9	3	15	15	20	18
Unknown										
Regarding your total experience, evaluate your overall clinical exposure to anesthesiology as to its effect on your attitudes.	11	27	33	8	8	3	15	17	24	16
Favorable	10	43	63	59	59	38	32	75	24	24
Unfavorable	28	29	23	32	34	59	51	8	50	29
Unknown										



TABLE 8. Students' Consideration of Anesthesiology as a Career Choice by Source of Attitudes Toward the Specialty

	Are you considering anesthesiology as a career choice now?				Total Number
	Yes		No		
	Number	Per Cent	Number	Per Cent	
What prime factor influenced your attitude toward anesthesiology as a field?					
Routine exposure to anesthesiology	8	17	306	50	314
Routine exposure to surgery	1	2	83	14	84
Anesthesiology elective	14	30	47	8	61
Surgery elective	1	2	17	2	18
Anesthesiology preceptorship	11	24	42	7	53
Exposure to a specific anesthesiologist	8	17	96	16	104
Other	3	6	22	3	25
TOTAL*	46		613		659

\* Unknown responses are excluded; hence total does not add to  $N = 698$ .

tively). In addition, more students from Schools 6 and 7 evaluated their total experience in anesthesiology as to quality, value, and impact on their attitudes as unfavorable (59 and 51 per cent, respectively). While 50 per cent of the seniors in School 9 also indicated an unfavorable clinical experience in anesthesiology, 45 per cent of the students in this school cited routine exposure to surgery or a surgery elective as influencing their attitudes toward anesthesiology (see table 6).

Table 8 presents further data related to the third hypothesis, namely the influence of the preceptorship on students' career interests in medicine. A greater percentage of the 46 students who said that they were considering anesthesiology as a career choice cited electives (30 per cent) and preceptorships (24 per cent) in anesthesiology as the two prime factors that had influenced their attitude toward the specialty, while 50 per cent of the 613 students who said that they were not considering anesthesiology as a career choice cited routine exposure to anesthesiology as the prime factor that influenced their attitude toward the specialty.

### Discussion

There are several possible explanations for the lack of statistically significant differences between students who had and those who had

not participated in the preceptorship program in terms of their correct responses to the six knowledge areas of anesthesiology. First, several of the questions were not discriminating enough, in that 96 per cent of all students correctly answered the question on lumbar puncture and 91 per cent correctly answered the question on the management of shock. Second, it is reasonable to expect that the two groups of students would not differ in their knowledge of these areas, but rather that preceptorship students would have the opportunity to learn in a one-to-one context and have a greater opportunity to apply their knowledge. The survey instrument did not, however, include questions which explored students' learning environments and their opportunities to apply knowledge. Third, the lack of difference may reflect the fact that the knowledge content of the preceptorship did not differ from the content of anesthesiology taught in the medical school curriculum. Therefore, student responses to the questions may reflect their knowledge of anesthesiology irrespective of where they acquired that knowledge.

Preceptorship students regarded their skills in intubation and positive-pressure ventilation as more adequate than non-preceptorship students. Although preceptorship students regarded their skills in these areas as more adequate than non-preceptorship students, the

former group did not indicate a greater knowledge of these areas.

Preceptorship students primarily acquired knowledge regarding endotracheal intubation during their preceptorship, while non-preceptorship students learned this information during their anesthesiology or internal medicine rotations. However, perhaps more important is the fact that most of the knowledge about anesthesiology over which the students were questioned was acquired on non-anesthesiology services.

There were no relationships between knowledge, the assessment of the adequacy of skills, and students' attitudes toward anesthesiology as a specialty. Indeed, of the four medical schools in which seniors performed best on the knowledge questions, more students in two of these schools had very positive attitudes toward the specialty, while more students in the other two schools had negative attitudes toward the specialty. The type of exposure to anesthesiology as a field varied among medical schools and appeared to be a crucial factor in influencing attitudes. Working with a specific anesthesiologist or in a one-to-one relationship in a preceptorship setting was associated with more positive attitudes toward the specialty than was routine exposure to the field. Nevertheless, routine exposure to anesthesiology was not always associated with negative attitudes. The type of teaching-learning interaction in each anesthesiology department would seem to be a more pervasive factor in influencing student attitudes than solely whether the student learns

anesthesiology through routine exposure, an elective, or a preceptorship.

There are always limitations to survey data, in part because of practical considerations in designing an instrument of reasonable length to ensure greater response and in part because of inability to obtain qualitative data to aid in the interpretation of results. However, the present data do indicate that knowledge and adequacy of skills do not in themselves lead to more positive attitudes toward anesthesiology. Most important is the context in which knowledge is acquired, how it is acquired, and the opportunity to apply it. As these data indicate, the teaching-learning environment for anesthesiology varies among medical schools. Therefore, generalizations about students' knowledge, skills, and attitudes across the ten schools included here undoubtedly obscure many significant factors within each medical school which influence the learning of anesthesiology. The preceptorship is not a panacea, but rather provides an alternative learning environment for medical students, which has been shown to enhance their understanding of the field.<sup>1</sup>

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### Reference

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