

Evaluating Programs for Recruiting and Retaining Community Faculty

Peg Boyle Single, PhD; Arnold Jaffe, PhD; Robert Schwartz, MD

Background and Objectives: *There is a need to develop ambulatory care components within medical schools and, accordingly, a need to recruit community faculty. To assist in recruiting and retaining community faculty, this study addresses factors influencing physicians' decisions to serve as preceptors. The study also examines the relative value of incentives as rated by physicians in different primary care specialties. **Methods:** We surveyed community physicians affiliated with a large, public teaching hospital. Physicians rated prior experiences training students in ambulatory settings, plans for serving as preceptors within the next year, and 7 incentives for serving as preceptors. **Results:** A path analysis indicated that prior experiences and student influence on patient care affected future decisions to serve as preceptors. Analysis of the incentives for serving as preceptors indicated that physicians rated receiving continuing medical education (CME) credit the most favorably and financial compensation the least favorably. Overall, family physicians assigned the highest ratings to the incentives, and gynecologists gave the lowest ratings. **Conclusions:** This study produced a better understanding of the factors influencing physicians' decisions to serve as preceptors. Physicians are more concerned about students' influence on patient care than they are about students' influence on patient billings. In addition, preceptors preferred receiving nonmonetary compensation, such as CME credit, rather than receiving financial compensation. In addition, this study suggests better ways to reward community physicians for their service as preceptors. Community faculty should not be viewed as a homogenous group. The results of this study suggest that community physicians be provided with choices regarding the incentives for and rewards associated with serving as preceptors.*

(Fam Med 1999;31(2):114-21.)

Article can be retrieved from: www.uvm.edu/~pbsingle

Two trends in academic medicine have increased the need for community faculty. The first trend is the expansion of community-based teaching, one of the "good ideas" of education reform.^{1,2} With this trend, medical schools have needed to recruit more community physicians to train medical students in ambulatory settings.³ The second trend is the increase in mandatory primary care educational experiences aimed at recruiting students into primary care specialties. These experiences have proven effective and have increased the percentage of students choosing generalist professions.^{4,5} With

more students training in generalist professions, more ambulatory training opportunities need to be developed.⁶

The heightened demand for ambulatory medical training centers has motivated researchers to examine factors that influence physicians' decisions to serve as preceptors. On the positive side, physicians train students for the intrinsic joy of teaching, professional growth, and the personal satisfaction of training the next generation of physicians.⁷ Functioning as a preceptor allows generalist physicians to relate the personal and professional rewards of general medicine to their students.^{3,8}

The costs associated with serving as preceptors have also received attention. Physicians believe that training students decreases their productivity.⁹ The estimated cost of training a medical student in an ambulatory setting is between \$52 and \$84 per student per day, based on reductions in patient billings for family physicians,

From MentorNet, the National Electronic Industrial Mentoring Network for Women in Engineering and Science, San Jose State University, San Jose, Calif (Dr Single); the Department of Family Medicine, State University of New York at Stony Brook (Dr Jaffe); and the Department of Family Medicine and Community Health, University of Miami (Dr Schwartz).

internists, and generalist pediatricians,^{10,11} with less-advanced trainees negatively influencing patient billings more than advanced trainees.¹² In addition, physician preceptors recount working longer days while educating medical students in ambulatory settings.^{8,13}

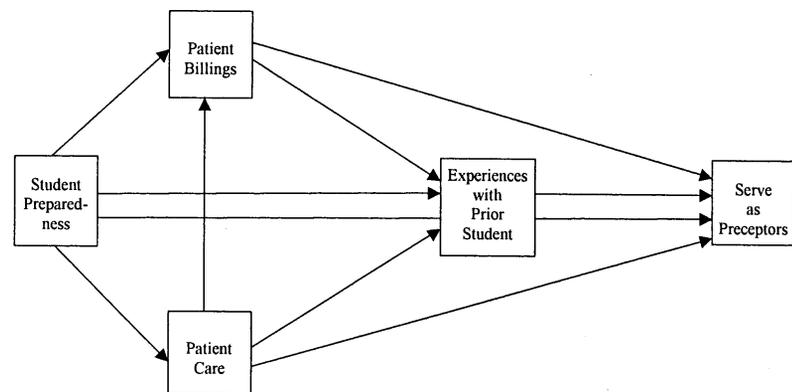
While past research has identified correlates of serving as preceptors, to date that research has failed to identify predictors associated with serving as preceptors. Past research has not compared the perceived costs of serving as preceptors to determine whether or not the costs influence future decisions to serve. The research described in this report examines predictors associated with serving as preceptors and investigates the relative influence of the predictor variables.

The predictor variables included in this study are student influences on patient care, student influences on patient billings, students' level of preparedness for contributing to an ambulatory setting, and physicians' experiences training a student in the past. Figure 1 shows the hypothesized relationships among the variables. All the direct and indirect relationships among the variables are assumed to be positive except for the relationship between patient care and patient billings, which we assumed to be negative. We hypothesized that when students spend more time with patients to enhance patient care, fewer patients could be seen per day, and patient billings would decrease.

Along with examining the factors that influence physicians' decisions to serve as preceptors, this study has a second aim—to compare how physicians from different primary care specialties rate possible incentives for serving as preceptors. Rewards and incentives for serving as preceptors have routinely been offered to community physicians. In past studies, preceptors have rated continuing medical education (CME) credit as the most highly prized incentive.⁸ Other highly rated incentives include being able to attend CME courses for free, receiving professional recognition for training students, and being provided with nonmonetary material rewards (eg, access to MEDLINE and journals). Being paid for their service has received mixed responses; compared with other incentives, community physicians have rated financial compensation the most favorably in one survey study¹⁴ but the least favorably in other studies.^{7,8}

Figure 1

Proposed Path Diagram for Predicting Community Physicians' Decisions to Serve as Preceptors



The proposed path diagram shows the hypothesized relationship among the variables. All the direct and indirect effects are assumed to be positive except for the effect between student influence on patient care and student influence on patient billings, which we assumed to be negative.

Nevertheless, we should not assume that all community physicians would rate the incentives similarly. For instance, Langlois¹⁴ compared physician ratings of incentives based on characteristics of physicians' private practices. He found that physicians who identified themselves as practicing in rural areas ranked receiving financial support for serving as preceptors higher than did physicians practicing in suburban and urban areas. In contrast, physicians in urban areas preferred to receive CME credit and to attend CME courses for gratis. To build on these findings, we examine whether community physicians from four specialties (family practice, OB-GYN, pediatrics, internal medicine) would differentially rate incentives for serving as preceptors.

Methods

Sample and Procedures

We sent surveys to all primary care physicians affiliated with a large, public teaching hospital. The 402 community physicians included 115 family physicians, 145 internists, 65 obstetrician-gynecologists, and 77 pediatricians. Not all physicians were currently active preceptors.

To increase the response rate, we enclosed self-addressed stamped envelopes (SASEs) in the original mailing. Within 2 months of the original mailing, we sent follow-up letters with questionnaires and SASEs to the nonrespondents.

Survey Instrument

The survey instrument requested physicians to identify the type of student (ie, medical student or nurse practitioner/physician assistant [NP/PA] student) and the level of training (first year, summer internship, third-year clerkship, fourth-year primary care elective) of the student they most recently trained. We asked the physicians to rate the student they most recently trained because the experience would be freshest in their minds and would create a more accurate representation of their experiences. In addition, these instructions helped eliminate any bias where physicians might rate their experiences training their most memorable student, which would most likely be either their best or their worst student.

Physicians rated how prepared the student was to assist in the office based on a 5-point scale from "not very prepared" to "very prepared." Physicians rated the effect of having a student in their office on patient care, the effect on patient billings, and their experiences with prior students, all on a 5-point scale from "negative" to "positive." The respondents also rated the likelihood of volunteering to serve as preceptors within the next 12 months, again on a 5-point scale, this time from "not very likely" to "very likely." The incentives portion of the survey asked physicians to rate 7 incentives for volunteering as preceptors on a 5-point scale from 1="not very enticing" to 5="very enticing." The 7 incentives, chosen based on a review of the literature, were 1) receiving CME credit, 2) attending other CME programs for free, 3) receiving an academic appointment and a teaching certificate, 4) being eligible for a teaching award, 5) obtaining free MEDLINE access, journal subscriptions, and books, 6) receiving financial compensation, and 7) having access to faculty development and training seminars.

The survey instrument was finalized after input from four primary care physicians (one from each specialty). The questionnaire took approximately 10 minutes to complete.

Analysis Methods

Survey data were analyzed using path analysis, multivariate analysis of variance (MANOVA), and analysis of variance (ANOVA). Path analysis was the primary statistical technique used to analyze predictor variables associated with serving as preceptors. Path analysis is a form of regression analysis that estimates the direct and indirect causal relationships among variables. Results are reported as standardized (beta) regression coefficients at a

significance level of .05. (See Appendix for a brief explanation of the purposes and methods of path analysis.)

We used MANOVA and ANOVA techniques to examine the ratings of the 7 incentives by physician specialty. We used MANOVA to determine whether overall differences existed and then used ANOVA techniques to further analyze the data.

Results

Response Rate

The final sample of 184 physicians represented 46% of those who had been sent surveys. The respondents included 47 family physicians, 53 internists, 41 obstetrician-gynecologists, and 43 pediatricians. Forty-one percent of the family physicians who were sent surveys responded, as did 37% of the internists, 63% of the obstetrician-gynecologists, and 56% of the pediatricians. Analyses reported below differ in the sample size because not all physicians answered all survey questions.

Predictors of Serving as Preceptors

When examining predictors of serving as preceptors, the correlations in Table 1 present an initial test of our hypotheses. These preliminary results suggest that some of the hypothesized relationships are supported by the data. The correlations show that physicians' decisions to serve as preceptors are correlated with prior experiences serving as preceptors. In addition, prior experiences serving as preceptors are correlated with student

Table 1

Intercorrelations Among Variables Used to Conduct the Path Analysis to Predict Physicians' Decisions to Serve as Preceptors

	<i>Serve as Preceptors</i>	<i>Experiences With Prior Student</i>	<i>Patient Care</i>	<i>Patient Billings</i>	<i>Student Preparedness</i>
Serve as preceptors	—	.43*	.13	.10	-.11
Experiences with prior student	n=97	—	.48 *	-.04	.46 *
Patient care	n=92	n=93	—	.19	.38 *
Patient billings	n=66	n=66	n=66	—	.13
Student preparedness	n=81	n=81	n=79	n=60	—
Mean	4.02	4.42	3.36	2.79	3.59
SD	1.30	.92	1.22	.77	1.03

Community physicians rated items on a 5-point scale from 1=not very likely, negative, or not very prepared to 5=very likely, positive, or very prepared.

* $P < .01$

SD—standard deviation

Figure 2

Output Path Diagram to Predict Community Physicians' Decisions to Serve as Preceptors

Paths are standardized correlation coefficients significant at the $P < .05$ level.

influences on patient care and with student preparedness to assist in an ambulatory setting. Finally, student influence on patient care is correlated with student preparedness. The relationships between patient billings and the other variables were not supported by the data.

A path analysis was conducted to fit the proposed path model shown in Figure 1. Since all the paths leading to and from the patient billings variable were not significant, this variable was removed, and the path model was refit. The new model was fit by running a series of 3 linear regression equations. The first equation, which regressed decisions to serve as preceptors on prior experiences, student influence on patient care, and student preparedness, was significant ($F[3,74]=3.08, P < .03$). Prior experiences serving as preceptors was the only variable from this equation to have a statistically significant regression coefficient ($\beta = .38$). The second equation, which regressed experiences with the prior student on patient care variable and the student preparedness variable, was also significant ($F[2,76]=14.55, P < .001$). Patient care ($\beta = .41$) and student preparedness ($\beta = .23$) both had significant regression coefficients. The third and final equation, which regressed the patient care variable on the student preparedness variable, was significant ($F[1,78]=13.15, P < .001, \beta = .38$). Only the significant paths, as identified by significant beta coefficients, were kept in the model.

two paths connecting the student preparedness variable and the serve as preceptors variable.

To determine the goodness of fit of the path model to the observed data, we compared the observed correlations (the Pearson correlation coefficients shown in Table 1) to the correlations predicted by the model. The correlations predicted by the model are represented by the total effect for each predictor variable. If a model provides a good fit for a set of data, the observed correlations and the reproduced correlations should be similar. As indicated in Table 2, the reproduced correlations are similar to the observed correlations, and we

Table 2

Goodness-of-fit Test for the Path Model: Comparison of the Observed Versus Reproduced Correlations

	<i>Serve as Preceptors</i>	<i>Experiences With Prior Student</i>	<i>Patient Care</i>	<i>Student Preparedness</i>
Serve as preceptors	—	.43	.13	-.11
Experiences with prior student	.40	—	.48	.46
Patient care	.16	.41	—	.38
Student preparedness	.15	.23	.38	—

The observed correlations appear above the diagonal and are shaded. The reproduced correlations appear below the diagonal.

The output path diagram (Figure 2) shows that prior experiences serving as preceptors was the only variable with a significant direct influence (.40) on decisions to serve as preceptors. In our model, student influence on patient care indirectly influenced future decisions to serve as preceptors, by way of physicians' prior experiences, and had a total indirect effect of .16. This indirect effect was calculated by multiplying all the significant paths between the patient care variable and the serve as preceptors variable. Student preparedness also indirectly affected future decisions to serve as preceptors, mediated by both physicians' prior experiences and student influence on patient care. Student preparedness had a total indirect effect of .15. This indirect effect was calculated by adding together the product of the path coefficients for the

concluded that the model provided an adequate fit for the data.

Student Level and Student Preparedness. This study also investigated whether student type and level of training influenced preceptors' ratings of student preparedness. Whether a student was a medical student or an NP/PA student did not influence how prepared they were to assist in an ambulatory setting. The data did support, however, the relationship between level of medical students' training and physician ratings of student preparedness ($r=.23$, $P<.05$). Not surprisingly, the more-advanced medical students received higher student preparedness ratings.

Ratings of Incentives for Full Sample and by Primary Care Specialties

Overall. Of the 7 incentives, community physicians rated receiving CME credit the highest. Being able to attend CME programs free was a close second, followed by increased recognition for functioning as a preceptor. The community physicians rated receiving financial compensation the least favorably. Table 3 shows means, standard deviations, and rankings of the incentives by the full sample.

Incentive Ratings by Specialty. MANOVA procedures revealed a significant difference among the physicians from the family practice, pediatric, OB-GYN, and internal medicine specialties (Wilk's $\lambda=2.73$, $P<.0001$). Table 4 shows the overall ratings of incentives along with the ratings of the individual incentives by the four specialties. ANOVA results and Sheffe tests of means

Table 3

Community Physician Ratings of Incentives for Serving as Preceptors

Incentive	Ranking	Mean	SD
CME credit	1	3.75	1.31
Free CME programs	2	3.46	1.40
Recognition	3	3.24	1.44
Faculty development	4	3.12	1.31
MEDLINE, etc	5	3.00	1.38
Teaching award	6	2.95	1.39
Financial compensation	7	2.78	1.47

SD—standard deviation

CME—continuing medical education

Community physicians rated 7 incentives for serving as preceptors on a 5-point scale from 1=the incentive is not very enticing to 5=the incentive is very enticing.

indicated that family physicians rated the incentives significantly higher than gynecologists, pediatricians, and internists ($F[3,164]=3.83$, $P<.01$). While not significantly different from pediatricians and internists, gynecologists provided the lowest combined ratings for the incentives.

When examining each of the incentives separately, the data suggest that family physicians rated financial compensation ($F[3,159]=3.97$, $P<.01$) and CME credit ($F[3,163]=3.55$, $P<.02$) higher than internists, pediatricians, and gynecologists. Both internists and family physicians rated teaching award more favorably than

Table 4

Comparison of Community Physicians' Ratings of Incentives for Serving as Preceptors, by Subspecialty

Incentive	FAMILY PHYSICIANS		INTERNISTS		PEDIATRICIANS		OBSTETRICIAN-GYNECOLOGISTS		RESULTS ANOVA
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	
All incentives	3.57 ^a	(.91)	3.18 ^b	(1.00)	3.02 ^b	(0.91)	2.88 ^b	(1.12)	$P<.01$
CME credit	4.19 ^a	(1.12)	3.35 ^b	(1.38)	3.62 ^b	(1.27)	3.82 ^b	(1.38)	$P<.02$
Free CME programs	3.89	(1.28)	3.26	(1.36)	3.47	(1.31)	3.06	(1.61)	$P<.05$
Recognition	3.54	(1.28)	3.13	(1.47)	3.33	(1.36)	2.94	(1.64)	
Faculty development	3.35	(1.37)	3.26	(1.31)	2.85	(1.14)	2.87	(1.36)	
MEDLINE, etc	3.47	(1.49)	2.89	(1.32)	2.82	(1.21)	2.65	(1.40)	$P<.04$
Teaching award	3.41 ^a	(1.34)	3.13 ^a	(1.39)	2.82 ^b	(1.27)	2.16 ^b	(1.29)	$P<.001$
Financial compensation	3.20 ^a	(1.54)	3.02 ^b	(1.41)	2.24 ^b	(1.30)	2.50 ^b	(1.43)	$P<.01$

CME—continuing medical education

SD—standard deviation

Community physicians rated 7 incentives for serving as preceptors on a 5-point scale from 1=the incentive is not very enticing to 5=the incentive is very enticing.

The superscripts a and b indicate significant differences among the means of the incentive ratings. The means with the superscript a and the superscript b are different at the $P<.05$ level according to Sheffe tests of means.

did gynecologists and pediatricians ($F[3,160]=5.87$, $P<.001$). ANOVA results showed a significant difference in the ratings for free CME programs ($F[3,156]=2.62$, $P<.05$) and MEDLINE, etc ($F[3,160]=2.87$, $P<.04$). For these incentives, however, no two groups were significantly different using the Sheffe tests of means.

Discussion

Response Rate

Had we surveyed almost any other population, we would have considered the response rate of 46% to be low. Overall, surveys of physicians often have lower response rates than surveys of other populations. For example, Tambor et al¹⁵ received an average response rate of 19.6% from physicians when sending out a survey with a sponsorship letter and a follow-up postcard. The response rate increased dramatically, to 64.8%, when follow-up surveys were sent and when incentives for completing the survey were offered. Tambor's study also reported that the respondents were more engaged in the subject matter of the questionnaire than were the nonrespondents. Therefore, our results may be most relevant to program planners for recruiting interested physicians or retaining currently involved physicians.

Influences on Recruiting and Retaining Community Faculty

Patient Care and Student Preparation. The current climate of medical care is changing due to the increased influence of managed care and limits on medical reimbursements. One might hypothesize, therefore, that financial considerations are a primary motivational force that influence decisions to train medical students. On the contrary, this study suggests that influences on patient billings do not influence future plans to serve as preceptors. Rather, these community physicians, when deciding whether to serve as preceptors, are influenced by their past experiences training students and by the students' influence on patient care.

Accordingly, perceptions of patient care were affected by student preparedness for functioning in an ambulatory care setting. Not surprisingly, the more-advanced students, such as the third-year clerkship students, were rated as more prepared than the first-year summer internship students. These findings suggest that improving student preparedness could aid in retaining preceptors. If teaching programs could send students better prepared to have a positive effect on patient care, it would increase physicians' experiences training students and improve the likelihood of the physicians serving as preceptors in the future. In addition, since the lower-division students have a less favorable effect on patient care, teaching programs may want to offer higher incentives to physicians training first- and second-year

medical students, compared with the incentives offered to physicians who are training third-year students and residents.

Incentives. Similar to prior research findings, receiving CME credit was the most favorably rated incentive for functioning as preceptors. By receiving CME credit, community physicians are relieved of the time investment necessary to fulfill their annual CME requirements. Keeping in mind that time pressures are community physicians' greatest source of stress¹⁶ and that training students increases the length of the work week,^{8,13} rewarding them with CME credit for training students allows community physicians to offset one time commitment with another. Accordingly, serving as preceptors may be a worthwhile substitute for attending CME courses. Physicians serving as preceptors report that they learn from their students, especially about new techniques and research findings.⁸

In addition, this study found that receiving monetary compensation for serving as preceptors was the lowest-rated incentive. This finding, coupled with the lack of predictive value that student influence on patient billings had on volunteering as preceptors, suggests that financial considerations do not greatly influence community physicians' decisions to serve as preceptors.

Incentives by Specialty. Overall, family physicians rated the incentives they receive for teaching significantly higher than did gynecologists, pediatricians, and internists. Presumably, this is because family physicians may be able to assimilate students more easily into practice routines. In these private practices, students could quickly become contributing members of a health care team because patients would display the least hesitancy and discomfort in being seen and treated by a student. On the other hand, the gynecologists provided the lowest ratings of incentives they receive for teaching. Due to the nature of OB-GYN private practice, gynecologists may feel their patients are not comfortable being seen and treated by medical students. Consequently, gynecologists may believe that receiving the available incentives do not offset the perceived decrease in patient care and comfort.

To accommodate the individual needs of community faculty, Langlois¹⁵ suggested using a menu-type approach, where preceptors chose the incentives best suited to benefit their practice. We concur. Based on our analyses of the four primary care fields, offering a menu-type approach could best accommodate the specialty-specific needs of the physicians serving as preceptors.

Limitations

Since this study was conducted at a single site in a middle- to upper-middle-class suburban setting, the generalizability of our study may be limited. For example, our preceptors may be less motivated by financial compensation or influences on patient billings than physicians who practice in less-affluent areas.

Additionally, only physicians already affiliated with a teaching hospital were sent surveys. The majority of these physicians served as preceptors at one point, if not currently. Physicians who did not have previous affiliations could have rated the incentives differently than this population of physicians, who at one point had taken the initiative to serve as preceptors. Finally, while sending out the surveys, we were not aware of which physicians were currently active as preceptors and which were not. Therefore, we were not able to conduct analyses comparing the responses of the 2 groups.

Conclusions

There is an increased need for developing ambulatory care components within medical schools and, accordingly, for recruiting community faculty. This study produced a better understanding of the factors that influence physicians' decisions to serve as preceptors. When deciding to serve, physicians primarily considered the effect on patient care. To meet the current demand for community-based teaching, medical schools may explore ways to ensure that students have a positive influence on patient care. One way is to better prepare students prior to ambulatory training experiences. If this could be done, then students could more quickly become contributing members of the primary care teams and could provide better patient care from the start.

This study also suggests better ways to reward community physicians for their service as preceptors. When rating incentives for serving as preceptors, physicians rated receiving CME credit as the most favorable incentive and financial compensation as the least favorable. These findings suggest that physicians are not primarily motivated by financial gain to train medical students. Rather, physicians are more likely to serve as preceptors when they are provided with incentives, such as receiving CME credit, that will offset the additional time spent serving as preceptors.

Further, the different ratings of the incentives by specialty suggest that community faculty should not be viewed as a homogenous group. Physicians in some specialties, such as family practice, may find it easier to assimilate students into their practices; gynecologists may find it more difficult based on how the presence of students influences patient comfort and care. We recommend that community physicians be provided with choices regarding the incentives and rewards associated with serving as preceptors.

Acknowledgments: This study was supported by a Primary Care Education Grant from the New York State Department of Health to Drs Schwartz and Jaffe.

We thank Janet Fischel, PhD; Lisa Strano-Paul, MD; Nancy Levine, MD; and Mark Togliola, MD for their assistance in data collection. Thanks to Richard Usatine, MD, for graciously sending us a copy of his survey instrument, Richard M. Single, PhD, for assistance with data analysis, and Julie Exline, PhD, along with two anonymous reviewers, for their helpful comments.

Corresponding Author: Address correspondence to Dr Single, MentorNet, One Washington Square, c/o College of Engineering, San Jose State University, San Jose, CA 95192-0080. 408-924-4100. Fax: 408-924-4069. E-mail: pboyle@email.sjsu.edu.

REFERENCES

1. Friedman CP. Of warps and woofs: the tapestry of medical education. *Acad Med* 1993;68(suppl):S50-S54.
2. Perkoff GT. Teaching clinical medicine in the ambulatory setting: an idea whose time may have finally come. *N Engl J Med* 1986;314:27-31.
3. Greer DS. Faculty rewards for the generalist clinician-teacher. *J Gen Intern Med* 1990;1(suppl):S53-S58.
4. Musham C, Chessman A. Changes in medical students' perceptions of family medicine resulting from a required clerkship. *Fam Med* 1994;26(8):500-3.
5. Stine CC, Sheets KJ, Calonge BN. Association between clinical experiences in family medicine or in primary care and the percentage of graduates entering family medicine residencies. *Acad Med* 1992;67:475-7.
6. Kahn NB Jr, Garner JG, Schmittling GT, Ostergaard DJ, Graham R. Results of the 1995 National Resident Matching Program: family practice. *Fam Med* 1995;27(8):501-5.
7. Fulkerson PK, Wang-Cheng R. Community-based faculty: motivation and rewards. *Fam Med* 1997;29(2):105-7.
8. Usatine RP, Hodgson CS, Marshall ET, Whitman DW, Slavin SJ, Wilkes MS. Reactions of family medicine community preceptors to teaching medical students. *Fam Med* 1995;27(8):566-70.
9. Kearsal GW, Mainous AG. Physicians' productivity and teaching responsibilities. *Acad Med* 1993;68:166-7.
10. Fields SA, Toffler WL, Bledsoe NM. Impact of the presence of a third-year medical student on gross charges and patient volumes in 22 rural community practices. *Acad Med* 1994;60(suppl):S87-S89.
11. Pawlson LG, Watkins R., Donaldson M. The cost of medical student instruction in the practice setting. *J Fam Pract* 1980;10:847-52.
12. Jones TF. The cost of outpatient training of residents in a community health center. *Fam Med* 1997;29(5):347-52.
13. Vinson DC, Paden C. The effect of teaching medical students on private practitioners' workloads. *Acad Med* 1994;69:237-8.
14. Langlois JP. Support of community preceptors: what do they need? *Fam Med* 1995;27(9):641-5.
15. Tambor ES, Chase GA, Faden RR, Geller G, Hofman KJ, Holtzman NA. Improving response rates through incentive and follow-up: the effect on a survey of physicians' knowledge of genetics. *Am J Public Health* 1993;83(1):1599-603.
16. Mawardi BH. Satisfaction, dissatisfaction, and causes of stress in medical practice. *JAMA* 1979;41:1483-6.
17. Musil CM, Jones SL, Warner CD. Structural equation modeling and its relationship to multiple regression and factor analysis. *Res Nurs Health* 1998;21:271-81.
18. Cohen J, Cohen P. *Applied multiple regression/correlation analysis for the behavioral sciences: second edition.* Hillsdale, NJ: Lawrence Erlbaum Associates, 1983.

Appendix

Explanation of the Purpose and Methods of the Path Analysis Technique

Path analysis is used when one wants to examine how various factors predict one outcome. Path analysis allows for the comparison of the relative magnitude of the predictor variables and, unlike multiple regression, permits the inclusion of mediator variables. Therefore, path analysis can test both direct and indirect predictors of an outcome variable and provides a way to examine the relative strength of each predictor variable. The relationship among the variables must be determined a priori, that is, based on previous knowledge or research about the variables included in the model.

Similar to multiple regression, path analysis is based on correlation analysis. Assuming that the path model is a just-identified, recursive model, the analyses can be conducted by running a series of multiple regression equations. A just-identified model is one in which the number of paths in the model equals the number of correlations among the variables. A recursive model has no feedback loops, and so the relationships among the variables flow in one direction.

The regression equations are used to estimate the path coefficients (ie, the relative magnitude of the predictor variables).¹⁷ The analyses start from the primary output variable, which is at the right-most part of the model in Figure 1. The primary output variable is regressed on all other variables in the model. In the subsequent regression equation, the next right-most variable is regressed on all of the variables that have a path leading directly to it. This procedure is repeated until all of the regression equations of this type have been executed.

The path coefficients are typically reported as standardized regression coefficients, as opposed to unstandardized coefficients, to allow for the comparison of the relative magnitude of predictor variables, independent of the original units of measurement used for each variable.¹⁸ The paths that are statistically significant are retained in the final, or output, path diagram. Direct effects are represented by the path coefficients and refer to the strength of a relation between a predictor variable and an output variable, controlling for the other variables in the model. Indirect effects of predictor variables on the outcome variable are calculated by multiplying together the path coefficients of each significant path connecting the two variables.
