BECOMING A PHYSICIAN: The Influence of the Undergraduate Experience

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This study employed a national sample of college students who initially aspired to be, or later became, physicians to determine the influence of precollege characteristics, college origins, and the academic and social experience of college on the likelihood of becoming a physician. Estimates of a 14-variable causal model indicated that the major direct effects on attainment were attributable to college characteristics and the academic experience of college. Net of other causes, the selectivity/prestige of the undergraduate institution attended, collegiate academic achievement, and majoring in the physical or life sciences each had significant direct effects on becoming a physician. The direct positive influence of college quality, however, was partially counterbalanced by its negative indirect effect. Moreover, the greatest advantage in attending an elite institution accrued to those students with relatively high levels of academic performance. As academic performance declined, so did the positive effect of college quality. The effects of precollege characteristics on becoming a physician were largely indirect, mediated by the student's college experience. Net of other factors, women were no less likely than men to become physicians, but being female had a significant negative indirect effect. Conversely, secondary school achievement did not directly influence attainment but did have a large positive indirect influence.

Occupational attainment has frequently been studied as a salient achievement outcome of postsecondary education (e.g., Alwin, 1974; Sewell and Hauser, 1975; Smart, 1986; Spaeth and Greeley, 1970; Tinto, 1980, 1984; Trusheim and Crouse, 1981). The results of this body of research suggest that those with a college degree have a distinct advantage, relative to those

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who end their education with secondary school, in terms of subsequent occupational attainment (e.g., Blau and Duncan, 1967; Jencks et al., 1972, 1979; Sewell and Hauser, 1975; Sewell et al., 1976). The kinds of institutions attended by college students and their academic performance within those institutions, however, may have little impact on subsequent general occupational attainment when variation due to student social origin, academic ability, and aspiration is taken into account (e.g., Alwin, 1974; Jencks, 1972; Sewell and Hauser, 1975; Treiman and Terrell, 1975; Trusheim and Crouse, 1981).

As suggested by Smart (1986), there may be at least two reasons for the apparent minimal association between undergraduate institutional characteristics and measures of subsequent career attainment. One of these is conceptual in nature, while the other is basically methodological. The conceptual problem, as developed by Tinto (1980), suggests that status attainment research has treated all occupations in an undifferentiated manner, based on the unwarranted assumption that there is but a single labor market. Theoretical and empirical work by Montagna (1977) and Tinto (1980, 1981), however, suggests that there may be a segmented labor market in which the salient factors influencing occupational status attainment vary for different occupations or careers. Supporting this notion of a segmented labor market in the professions is evidence indicating substantial variation in the career attainment processes for lawyers (Smigel, 1964), scientists (Zuckerman, 1977), engineers (Perucci and Perucci, 1970), and university professors (Crane, 1969; Hargens, 1969).

Recent evidence by Tinto (1980, 1981) suggests that there may be reasons to suspect nontrivial differences in both the degree and manner in which college characteristics and college experiences influence the process of career attainment in various occupations. Professional occupations, he notes, are characterized by the centrality of intellectual skills and knowledge requirements that are typically acquired in formal educational settings, such as college. On the other hand, nonprofessional (e.g., business-managerial) careers are more likely to require the development of interests and skills that are learned in work settings. Consequently, Tinto further proposed that college origins and educational attainments have a more important influence on career attainment in the professions than in nonprofessional careers. The findings from a national sample of white male college graduates, broadly dichotomized into professional and business-managerial careers, tends to support this premise, although Tinto's (1980) regression model lacks a measure of precollege academic ability or achievement. More recent findings by Smart (1986) using a similar approach are somewhat less supportive. Taken together, however, the results of this status attainment work by Tinto and Smart suggest that undergraduate college origins and individual

experiences may play a central role in career attainment when specific professions are considered.

The second, methodological, problem concerns the rather limited way in which variations in the collegiate experience have been measured in status attainment research. The two most commonly used measures of the collegiate experience in status attainment investigations have been the selectivity/prestige of the undergraduate institution attended and the student's undergraduate grade-point average (Cohen, 1984; Smart, 1986; Solmon, 1975). As argued by Kerckhoff et al., (1982) and Smart and Pascarella (1986), the use of one or two measures cannot begin to capture the full complexity of the college experience. Consequently, the status attainment research may be underestimating the true effect of between and within college differences on career attainment relative to the effects of student social origin and precollege variables.

Related to this general failure to portray adequately the complexity of the collegiate experience is the tendency, with a few notable exceptions (e.g., Alwin, 1974; Tinto, 1980), to focus on the direct effects of the college experience on occupational attainment. Such an approach tends to ignore, or dismiss as secondary, potentially important indirect influences on status attainment through intervening variables. As a result, the total effect of educational experiences may be underestimated.

The purpose of the present study was to address these problems in existing research by assessing the direct and indirect impact of the undergraduate college experience on occupational attainment in one "prototype" profession, medicine (Goode, 1969). Specifically the study focused on students from a national sample, who at entrance to college aspired to become physicians (with an M.D. degree). The sample was followed over a nine-year period in an effort to determine the direct and indirect effects of social origins, secondary school experiences, undergraduate college characteristics, and specific academic and social aspects of the collegiate experience on becoming a physician.

CAUSAL MODEL

The factors influencing one's becoming a physician (or attaining an M.D. degree) were conceptualized as part of a general causal model. The development of this model was guided both by the seminal status attainment models (e.g., Blau and Duncan, 1967; Sewell and Hauser, 1975) and by models of college impact on student development (e.g., Chickering, 1969; Lacy, 1978). The status attainment literature tends to regard occupational attainment as the result of the complex interaction of the individual's background traits (e.g., social origins) and their subsequent experiences and achievements

(e.g., secondary school, college). The models of college impact have adopted much of the thinking typically associated with status attainment. One particularly useful model developed by Lacy (1978) suggests that college impact is a function of three major sources of influence: first, Student background or precollege characteristics (e.g., social origins, aspirations, secondary school attainments); second, Structural or organizational characteristics of the college attended (e.g., selectivity, size, configuration of student majors); and third, Interactions between students and the primary agents of socialization on campus (i.e., faculty and students).

Tinto (1975) has suggested what may be a fourth source of influence, academic integration. By academic integration he means the extent to which students have successful interactions with the institution's academic system (e.g., satisfactory academic performance, selection to academic honor societies). In this study Tinto's (1975) concept of academic integration was more directly labeled as collegiate academic achievement. Although other models proposed for the study of college impact (e.g., Astin, 1984; Pascarella, 1980; Weidman, 1984) differ somewhat in their focus, all would appear to acknowledge as a minimal core the four basic components discussed above: (1) student precollege characteristics, (2) institutional characteristics, (3) interactions with faculty and peers, and (4) level of academic achievement.

The causal model estimated in this study incorporates the principal constructs of both the status attainment and college impact models. The model is longitudinal and posits that the kind of undergraduate institution attended (e.g., selectivity/prestige, size, percentage of student majors in science) is a function of student precollege characteristics (e.g., ethnicity, sex, family socioeconomic status, secondary school experiences, occupational aspirations[1]). In turn, it is expected that student precollege characteristics and the kinds of undergraduate institutions attended will influence the nature of the student's collegiate experience (e.g., major field of study, academic achievement, social leadership experiences, and interaction with faculty). Within this block of variables, major field of study was hypothesized as causally prior to the other three variables. The model includes a measure of institutional size because previous evidence indicates that this variable influences students' levels of social interaction with peers and faculty. In turn, interaction with peers and faculty has been shown to positively influence degree completion, educational aspirations, and occupational aspirations (e.g., Ethington and Smart, 1986; Grigg, 1965; Gurin and Katz, 1966; Pascarella, 1985; Pascarella et al., 1987; Smart and Pascarella, 1986).

Finally, becoming a physician was hypothesized as dependent upon all preceding variables in the model. Consistent with the suggestions of Tinto (1980) and Smart (1986), however, it was expected that the strongest direct effects on becoming a physician would come from between-college char-

acteristics and within-college measures of the individual student's collegiate experience. The influence of precollege characteristics was expected to be largely indirect, mediated through the influence of these variables on the kind of undergraduate college that the student attends and his or her individual academic and social experiences at that institution.

Because this study assesses the various background and schooling influences on becoming a physician within a longitudinal causal model, it represents a major departure from existing research. Studies of the factors affecting physician career choice and attainment in medicine have been numerous (e.g., Rezler, 1969; Rezler, 1985; Zuckerman, 1978). This body of research, however, has largely ignored the complex process by which the individual's background characteristics, secondary school attainments, college origins, and specific academic and social experiences interact to influence his or her likelihood of becoming a physician.

METHOD

Sample

Data for this study were drawn from respondents to the 1971 and 1980 Cooperative Institutional Research Program (CIRP) surveys. The overall sample consisted of 10,326 students attending 487 colleges and universities varying in type and control. All respondents completed the initial CIRP survey upon entering college in the fall of 1971. This survey instrument obtained a broad array of information on students' family backgrounds, secondary school experiences, initial occupational aspirations, and personal characteristics. In 1980, approximately nine years later, the same respondents completed a follow-up instrument that collected information on their actual collegiate experiences as well as their educational and occupational achievements. The sampling scheme and design for the 1971 and 1980 CIRP surveys are discussed in detail by Astin (1982).

The sample was defined initially by selecting only those individuals who initially enrolled in 1971 as full-time freshman students in a four-year college or university and who attended only one institution during their undergraduate careers. The restriction on attending a single undergraduate institution was necessary in order to eliminate ambiguity in relationships between institutional characteristics and measures of the collegiate experience. The 1980 CIRP survey referred only to the last undergraduate institution attended, whereas institutional characteristics referred only to the first institution attended. The sample was further limited by selecting only those individuals meeting the above criteria who on enrolling in college in 1971 aspired to be physicians as their top occupational choice, or who became physicians in

1980 regardless of precollege aspirations. The latter group represents a very small part (less than 5%) of the sample. This yielded a final sample of 454 on whom the analyses were conducted.[2]

Variables

The model estimated in the study included four different variable sets ordered in a causal sequence:

1. *Student precollege variables:* gender, ethnicity, father a physician, mother a physician, secondary school academic achievement, secondary school social accomplishment, and family socioeconomic status.
2. *Undergraduate institutional characteristics:* institutional selectivity/prestige, institutional size, and percentage of students in the institution majoring in physical or life sciences.
3. *College experience variables:* physical/life sciences major, collegiate academic achievement, interaction with faculty/staff, social leadership experiences (within this variable set physical/life sciences major was considered causally antecedent to the other three variables).
4. *Dependent variable:* whether or not the individual was a physician (obtained the M.D. degree) in 1980.

The precollege student characteristics were obtained from the 1971 CIRP survey, the institutional characteristics were obtained from the Higher Education General Information Survey (Hegis) files available on the CIRP tape, and the remaining variables consisted of items from the 1980 CIRP follow-up survey. Table 1 presents full operational definitions for all variables in the model and their reliability estimates where appropriate.

Analyses

Student precollege characteristics were considered exogenous variables (determined from outside the causal system), whereas all other variables in the model were considered endogenous (determined from within the causal system). Estimation of the direct and indirect causal effects implied by the model was done in two parts. First, ordinary least squares regression was used to estimate the coefficients of the eight structural equations defining the general model. In solving these structural equations, each endogenous variable was regressed on all exogenous variables and all other causally antecedent endogenous variables in the model. This yielded eight sets of standardized regression coefficients representing the direct effects of causally antecedent variables on each of the endogenous measures. The size and sign of the standardized direct effect represents the amount of change in the

TABLE 1. Variable Definitions

Variable	Definition
	Student Precollege Variables
1. Gender	Female = 1; male = 0
2. Ethnicity	Caucasian = 1; minority = 0
3. Father a physician	Yes = 1; no = 0
4. Mother a physician	Yes = 1; no = 0
5. Secondary school academic achievement[a]	Sum of secondary school grades (1 = "D," to 8 = "A or A+") and secondary school class rank (1 = "4th quarter," to 4 = "top quarter"); alpha reliability = .78
6. Secondary school social accomplishment	Sum of five secondary school social/leadership activities (e.g., "president of a student organization," "participated in a play"); coded 1 = "no"; 2 = "yes"; alpha reliability = .59
7. Family socioeconomic status (SES)[a]	Sum of parents' combined level of education (six categories, from "grammar school or less" to "postgraduate degree") and combined parental income (twelve categories, from "less than $4,000" to "$40,000 or more"); alpha reliability = .61
	Institutional Characteristics
8. Institutional selectivity/prestige[a]	A factorially derived scale that included the following institutional characteristics: (a) average academic ability of the entering class expressed as a combined SAT verbal and mathematics score, or the equivalent ACT composite score; (b) financial expenditures per student; (c) percentage graduate student enrollment; alpha reliability = .68
9. Institutional size[a]	A factorially derived scale that included the following three institutional characteristics: (a) student/faculty ratio, (b) total enrollment, and (c) public control; alpha reliability = .71
10. Percentage of students in the institution majoring in physical/life sciences	Average percentage of students in the institution majoring in physical sciences (e.g., physics, chemistry) or life sciences (e.g., biology, biochemistry, zoology)

TABLE 1. (*Continued*)

Variable	Definition
College Experience Variables	
11. Physical/life sciences major	Physical or life sciences major = 1; non-physical/life sciences major = 0
12. Collegiate academic achievement[a]	The sum of two items: (a) average undergraduate grades (coded: 1 = "D or less" to 6 = "A − or more"), and (b) membership in scholastic honor society (coded: 1 = no; 2 = yes); alpha reliability = .60
13. Interaction with faculty/staff	A single item: "knew a professor or administrator personally"; coded 1 = "no"; 2 = "yes"
14. Social leadership experiences	Sum of four items assessing the student's social/leadership involvement with peers ("president of one or more student organizations"; "served on a university or departmental committee"; "edited a school publication"; "had a major part in a play") alpha reliability = .46
Dependent Variable	
15. Became a physician	Became a physician (M.D. degree) in 1980 = 1; did not become a physician = 0

[a] Because the items constituting these scales were on a different metric, they were standardized prior to summation. A constant was added to eliminate negative scores.

dependent measure for every unit standard deviation change in the predictor variable, net of the effects of all other variables in the equation. As suggested by Pedhazur (1975), we let the standardized coefficients bear the main interpretative burden of relative importance of an effect, while the metric (unstandardized) coefficients, which are also reported, indicated statistical significance of an effect.

In the second step of the analyses the indirect effects of each variable in the model on becoming a physician were computed using GEMINI (Wolfle and Ethington, 1985), a FORTRAN program based on the work of Sobel (1982). Indirect effects are simply the sum of the products of direct effects through intervening variables in the model. The program developed by Wolfle and Ethington (1985) also computes the statistical significance of each effect.[3,4] Total causal effects, which are the sum of direct (unmediated) and indirect (mediated) effects, were computed and tested for significance with Alwin and Hauser's (1975) reduced form regression equation procedure.

RESULTS

Prior to the main analysis, a set of preliminary analyses was conducted to determine if there were significant gender or ethnicity differences in factors influencing one's likelihood of becoming a physician. In the first preliminary analysis, becoming a physician was regressed on all 14 independent variables in the model plus a set of terms that represented the cross products of gender and each independent variable. A significant cross product term would indicate a significant difference in the magnitude of a variable's direct effect between men and women. The results yielded no significant cross-product terms, indicating general equivalence between men and women in the direct effects of all independent variables. A similar analysis conducted adding the crossproducts of ethnicity and each independent variable yielded the same nonsignificant results. This suggests equivalence between whites and those of other races in the magnitudes of the direct effects of all independent variables on becoming a physician.

Finally the same type of analysis was conducted to determine if the entire set of seven student precollege variables interacted with the institutional characteristic and college experience variables. When the set of cross-product terms was added to the 14-variable model, the increase in R^2 was modest (i.e., less than 3%) and nonsignificant. This suggested that the direct effects of institutional characteristics and college experience variables were the same for all levels of student precollege traits.

Table 2 presents the means, standard deviations, and intercorrelations among all variables in the causal model. All subsequent analyses are based on these statistics.

Table 3 presents the standardized and metric coefficients for all structural equations. As shown in equation 15, the 14-variable model explained 21% of the variance in becoming a physician. While this is a modest percentage of explained variance, it should be remembered that the sample was restricted largely to those who aspired to be physicians at entrance to college. Not only does this function to attenuate variability in the sample, but it also effectively removes initial occupational aspiration as a potential explanatory variable in the analysis.

As further shown in equation 15, net of other influences only three variables had significant direct effects on becoming a physician. These were institutional selectivity/prestige (.20), majoring in the physical/life sciences (.24), and collegiate academic achievement (.27). None of the student precollege characteristics had significant direct effects on attainment, nor did measures of the student's social interaction with peers and faculty during college.

Table 4 summarizes the direct, indirect, and total causal effects of each variable on becoming a physician, their statistical significance, and the

TABLE 2. Means, Standard Deviations, and Intercorrelations among Variables[a]

Variable	*M*	*SD*	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender (1 = female; 0 = male)	.32	.47	−19	−07	00	14	−06	−06	−05	02	03	−08	01	−03	11	−04
2. Ethnicity (1 = Caucasian; 0 = minority)	.76	.43		17	05	23	03	32	00	−08	13	15	24	07	−12	07
3. Father a physician	.11	.32			23	−02	−01	42	05	−05	00	−01	01	01	−01	06
4. Mother a physician	.01	.08				07	00	07	02	−06	00	08	02	−03	−03	09
5. Secondary school academic achievement	21.01	1.53					17	06	36	−10	20	16	42	08	11	23
6. Secondary school social achievement	6.28	1.11						−03	05	−09	02	−02	06	11	18	−05
7. Family socioeconomic status	21.27	1.88							18	−03	09	−01	04	−01	−05	06
8. Institutional selectivity/prestige	22.64	3.18								08	33	−01	−05	−01	−10	18
9. Institutional size	8.72	2.16									−26	−11	−04	−08	−15	−04
10. Percent students in the institution majoring in physical/life sciences	16.52	8.32										13	04	03	−01	04
11. Physical/life science major	.53	.50											22	03	−03	30
12. Collegiate academic achievement	20.56	1.78												06	13	32
13. Interaction with faculty/staff	1.81	.39													16	00
14. Social leadership experiences	4.61	.85														−01
15. Became a physician	.23	.42														

[a] Decimals omitted from correlations.

TABLE 3. Standardized and Metric Parameter Estimates for All Structural Equations[a]

Variable	8	9	10	11	12	13	14	15
1. Gender (1 = female; 0 = male)	−.132	.009	.023	−.106	−.032	−.026	.063	−.030
	(−.899)**	(.042)	(4.007)	(−.113)*	(−.124)	(−.022)	(.114)	(−.027)
2. Ethnicity (1 = Caucasian; 0 = minority)	−.183	−.058	.078	.095	.103	.058	−.160	−.057
	(−1.368)**	(−.292)	(15.156)	(.111)	(.432)*	(.053)	(−.319)**	(−.056)
3. Father a physician	−.003	−.032	−.035	−.027	.015	.026	.031	.038
	(−.031)	(−.219)	(−9.090)	(−.042)	(.083)	(.032)	(.082)	(.050)
4. Mother a physician	−.013	−.040	−.009	.070	−.023	−.045	−.041	.046
	(−.514)	(−1.059)	(−9.023)	(.430)	(−.506)	(−.215)	(−.429)	(.233)
5. Secondary school academic achievement	.411	−.078	.173	.171	.467	.064	.156	.046
	(.855)**	(−.109)	(9.438)**	(.056)**	(.544)**	(.016)	(.086)**	(.013)
6. Secondary school social accomplishment	−.020	−.078	−.009	−.066	−.007	.090	.174	−.074
	(−.056)	(−.151)	(−.669)	(−.030)	(−.011)	(.032)	(.133)**	(−.028)
7. Family socioeconomic status	.210	.007	.067	−.046	.015	−.039	.017	.013
	(.354)**	(.009)	(2.958)	(−.012)	(.014)	(−.008)	(.008)	(.003)
8. Institutional selectivity/prestige				−.092	−.221	−.025	−.149	.202
				(−.015)	(−.124)**	(−.003)	(−.040)**	(.027)**
9. Institutional size				−.050	.051	−.057	−.126	−.051
				(−.012)	(.043)	(−.010)	(−.050)**	(−.009)
10. Percentage of students in the institution majoring in physical/life sciences				.107	−.000	.006	−.004	−.086
				(.001)*	(−.0000)	(.0000)	(−.0000)	(−.0004)
11. Physical/life sciences major					.127	.008	−.027	.242
					(.454)**	(.006)	(−.045)	(.202)**
12. Collegiate academic achievement								.270
								(.063)**
13. Interaction with faculty/staff								−.010
								(−.010)
14. Social leadership experiences								−.015
								(−.007)
15. Became a physician								
R^2	.191	.023	.050	.078	.255	.028	.111	.211

[a]Top number is the standardized estimate, number in parentheses is the unstandardized or metric coefficient.
*$p < .05$; **$p < .01$.

TABLE 4. Direct, Indirect, and Total Effects and Major Mediating Variables for Indirect Effects

Variable	Direct Effect	Indirect Effect	Total Effect	Mediating Variables (Indirect Effects)
1. Gender (1 = female; 0 = male)	−.030 (−.027)	−.056 (−.050)**	−.086 (−.077)	Institutional selectivity/prestige; physical/life sciences major; collegiate academic achievement
2. Ethnicity (1 = Caucasian; 0 = minority)	−.057 (−.056)	.033 (.033)	−.024 (−.023)	
3. Father a physician	.038 (.050)	−.001 (−.002)	.037 (.048)	
4. Mother a physician	.046 (.233)	.014 (.077)	.060 (.310)	
5. Secondary school academic achievement	.046 (.013)	.213 (.058)**	.259 (.071)**	Institutional selectivity/prestige; physical/life sciences major; collegiate academic achievement
6. Secondary school social accomplishment	−.074 (−.028)	−.022 (−.008)	−.096 (−.036)*	
7. Family socioeconomic status	.013 (.003)	.012 (.002)	.025 (.005)	
8. Institutional selectivity/prestige	.202 (.027)**	−.082 (−.011)**	.120 (.016)*	Physical/life sciences major; collegiate academic achievement
9. Institutional size	−.051 (−.009)	.002 (.000)	−.049 (−.009)	
10. Percentage of students in the institution majoring in physical/life sciences	−.086 (−.0004)	.029 (.0001)	−.057 (−.0003)	
11. Physical/life sciences major	.242 (.202)**	.034 (.029)**	.276 (.231)**	Collegiate academic achievement
12. Collegiate academic achievement[a]	.270 (.063)**			
13. Interaction with faculty/staff[a]	−.010 (−.010)			
14. Social leadership experiences[a]	−.015 (−.007)			

[a] Direct effects are total effects.
*$p < .05$; **$p < .01$.

mediating variables through which the major part of the indirect effect is transmitted. As Table 4 shows, two of the precollege variables had significant indirect effects on becoming a physician, even though their direct effects were nonsignificant. Net of other causes, being a woman did not directly disadvantage one's chances of becoming a physician; it did, however, have a significant negative indirect influence. This was due largely to the fact that, net of other factors, women were somewhat less likely to attend a selective/prestigious undergraduate institution, to major in the physical/life sciences, or to have sufficiently high levels of collegiate academic achievement. Each of these latter three variables, of course, had sizable positive direct effects on becoming a physician.

Net of other causes, secondary school academic performance did not directly influence one's chances of becoming a physician. It did, however, substantially improve one's likelihood of attending a selective/prestigious undergraduate college, of being a physical/life sciences major, and of performing well academically in college. The indirect effect of secondary school academic achievement, mediated largely through these three variables, was substantial (.21). Thus, while not directly affecting one's probability of becoming a physician, high academic performance in secondary school did facilitate a series of institutional, field of study, and performance advantages during college. These, in turn, significantly increased the probability of attaining the M.D. degree. Because of its substantial, positive indirect effect, secondary school academic achievement also had a significant total effect on becoming a physician. This was not the case with gender.

One of the three institutional characteristics assessed in the study, institutional selectivity/prestige, had a significant indirect effect on becoming a physician. This variable also had a significant direct effect. Interestingly, however, the sign of the direct effect was the reverse of the indirect effect. Other causes held constant, attending a selective/prestigious undergraduate institution directly increased the likelihood of becoming a physician. At the same time, however, attending such an institution decreased one's chances of exceptional academic performance and of majoring in the physical or life sciences. This, in turn, produced most of the negative indirect effect of attending a selective/prestigious undergraduate college on becoming a physician. As further shown in Table 4 the net total effect (direct and indirect) of institutional selectivity/prestige was positive and significant, indicating that its negative indirect effect was not sufficient to totally nullify its larger positive, direct influence.

It is also interesting to note that, net of other causes, attending an institution with a relatively high percentage of undergraduate physical or life science majors, increased the likelihood of an individual's majoring in the sciences. This, in turn, increased the likelihood of becoming a physician. The magnitude of this indirect influence, however, was not sufficient to be statistically reliable.

In addition to its positive direct effect, majoring in the physical or life sciences also indirectly enhanced the likelihood of becoming a physician. This positive, indirect effect was transmitted through collegiate academic performance. Not surprisingly, the total positive effect of being a science major was significant.

Finally, the only other variable to have a significant total effect on becoming a physician was secondary school social accomplishment. Although neither the negative direct or negative indirect effect of this variable was statistically significant, the total negative influence was.

CONCLUSIONS AND DISCUSSION

This study employed a national sample of college students who initially aspired to be, or subsequently became, physicians in an effort to determine the influence of precollege characteristics, college origins, and the academic and social experience of college on the likelihood of becoming a physician. A longitudinal causal model, guided by the status attainment and college impact literature and incorporating these variable sets, was estimated. The investigation, however, represents a departure from existing research in at least two ways. First, instead of attempting to explain status attainment across a wide range of occupations, the model was applied to the explanation of attainment in a specific profession. Second, in contrast to the majority of status attainment research, which typically includes only one or two educational variables, the study employed multiple measures of between-college characteristics and students' within-college academic and social/leadership experiences.

The results of the model estimation suggest a number of general conclusions. First, net of student's gender, ethnicity, social origins, and secondary school attainments, the college attended and the student's academic experience within that college have important direct and, to a somewhat lesser extent, indirect effects on an individual's probability of becoming a physician. Indeed, these specific contextual and achievement dimensions of the collegiate experience were clearly the most important influences on attainment in the model. In contrast, institutional characteristics such as enrollment and science emphasis, or measures of collegiate social involvement with peers and faculty had little direct or indirect influence on becoming a physician. Student precollege characteristics had only trivial and nonsignificant direct effects on becoming a physician. The major part of their influence was indirect, being mediated through college characteristics and the student's individual college experiences. Finally, there was little evidence in the analyses to suggest that the magnitude of variable direct effects on attainment differed in other than trivial ways by gender, ethnicity, or other student precollege characteristics.

The remainder of the discussion is structured according to major sets of predictor variables in the model. Direct, indirect, and total effects are discussed together.

Precollege Characteristics

The seven precollege characteristics in the model could be generally divided into three groups: ascribed characteristics (gender, ethnicity); social origins (parents' socioeconomic status, mother or father a physician); and secondary school attainments (secondary school academic and social accomplishments). Of these categories the social origin variables appeared to play the least important role in terms of impact on becoming a physician. None of the three SES measures had either a significant direct or indirect effect on attainment. This is inconsistent with recent evidence on status attainment in professional occupations as reported by Tinto (1980, 1981) and Smart (1986). However, such an inconsistency may be in large measure due to the more selective sample used in the present study (i.e., largely those who aspired to be physicians at entrance to college). Essentially eliminating initial occupational aspirations as an intervening variable also would eliminate the indirect influence of social origin on becoming a physician through its effects on aspiration.[5]

The most important impact of social origin in the analyses appeared to be on the characteristics of the undergraduate institution attended. Net of all other precollege variables, family socioeconomic status positively and directly enhanced the individual's likelihood of attending a small private college or a particularly selective/prestigious institution. The latter finding is quite consistent with previous research on the effects of social origin on the quality of the undergraduate institution attended (e.g., Hearn, 1984; Karabel and Astin, 1972). Clearly secondary school academic achievement had, by far, the strongest direct effect on institutional selectivity/prestige (.41). Even with academic achievement (as well as other precollege variables) taken into account, however, family socioeconomic status still had a substantial (.21) direct influence on institutional selectivity/prestige. Thus, regardless of academic performance in secondary school, an individual's social origins may provide an independent advantage or disadvantage in terms of the quality of the undergraduate institution attended. In the present analyses, however, this advantage (or disadvantage) was of insufficient magnitude to yield a statistically significant indirect impact on becoming a physician.

Two other background variables, however, did have significant indirect effects on attainment. Net of other factors, women were not directly disadvantaged in terms of realizing initial aspirations to become a physician. Nevertheless, being a woman did lead to a number of disadvantages at

critical points in the attainment process (e.g., the quality of the undergraduate institution attended, majoring in the physical or life sciences). The cumulative effect of these disadvantages was the significant, negative indirect influence of being female on becoming a physician.

A similar pattern held for secondary school academic performance. Net of other causes, one's secondary school achievement had only a trivial, direct effect on his or her chances of becoming a physician. Nevertheless, exceptionally high academic performance in secondary school conferred upon the individual a set of distinct advantages in areas that clearly enhanced the ultimate likelihood of attaining initial aspirations. These included an increased probability of attending an "elite" undergraduate college, higher levels of collegiate academic achievement, and perhaps the confidence to major in intellectually demanding fields that are closely related to the medical profession (i.e., the physical and life sciences).

College Characteristics and the Collegiate Experience

The findings of the present study are quite supportive of Tinto's (1980) hypothesis that college origins and academic accomplishment during college play a particularly central role in occupational attainment in the professions. At the same time, the nature of the impact of undergraduate college origin on becoming a physician was complex, its indirect effect being the reverse of its direct effect. Net of the other factors, for example, the quality (i.e., selectivity/prestige) of the individual's undergraduate institution directly enhanced his or her chances of becoming a physician. Conversely, the indirect effect of college selectivity/prestige on attainment was negative. Quite possibly the latter finding is attributable to the highly competitive nature of elite colleges and universities. Not only is a high level of academic achievement increasingly difficult to attain, but it is also possible that the most intellectually demanding majors (e.g., the physical/life sciences) are competitive enough to discourage selection by all but the most academically competent and committed.

This "relative deprivation" or "frog-pond" effect (Davis, 1966; Drew and Astin, 1972; Reitz, 1975) suggests that the attainment advantages that accrue to an individual attending a selective or prestigious undergraduate institution need to be balanced against the fact that academic rewards in those competitive environments are relatively more difficult to come by. If one is capable of obtaining those rewards, however, they may have relatively greater instrumental value because of the highly selective and competitive arena in which they were won. Thus, if confronted with two applications displaying roughly the same levels of acceptable academic performance, medical school admissions committees are perhaps more likely to give

greater weight to that record attained at what they judge to be the more competitive college.

To further test this hypothesis, we conducted an additional analysis, which regressed becoming a physician on all variables in the model, plus a cross product of institutional selectivity/prestige × collegiate academic achievement. Net of other variables, this cross product had a regression coefficient significant at $p < .01$ ($t = 3.03$). The metric coefficients equation for the variables involved (controlling all other effects) was $-.184$ (institutional selectivity/prestige) $-.164$ (collegiate academic achievement) $+.010$ (institutional selectivity/prestige × collegiate academic achievement). Using a method described by Cohen and Cohen (1975), it was determined that institutional selectivity/prestige had its strongest positive influence on becoming a physician for students with the relatively highest levels of college academic achievement. As level of achievement decreased, however, the relative advantage gained in attending an elite institution also declined.

This suggests that the substantive advantage gained by students attending an elite institution is activated only when such attendance is accompanied by a strong record of academic achievement. In this sense, the findings clearly support Tinto's (1980) hypothesis that the effect of college quality on attainment may be latent rather than active. Simply attending an elite institution may, in itself, be no real guarantee of a discernible advantage in attainment; nor does it appear to compensate for a mediocre or marginal academic record. Individuals must demonstrate academic competence, preferably as a science major, sufficient to make them competitive with other applicants to medical school. Once this relatively high level of competence is demonstrated, however, being at an elite institution provides the individual with an additional advantage in terms of becoming a physician. In short, the benefits of attending an elite institution are conditional upon demonstrating academic competence relative to others in that institution.

Finally, it is worth noting that social interaction variables, which have been shown to be positively associated with educational and occupational attainment generally, have little influence on becoming a physician. Net of other causes, neither a measure of interaction with faculty nor social leadership involvement significantly influenced attainment of the M.D. degree. (Consequently institution size, which tends to inhibit social interaction, did not have a negative indirect effect.) The only significant impact of a social interaction variable in the model was the total negative effect of secondary school social accomplishment. Such results suggest that social interaction variables, at least as operationalized in this study, play a trivial, or perhaps even a slightly negative role, in the attainments of the M.D. degree. Their exclusion from the model would appear to make little substantive difference. Whether this same pattern would hold for attainment in other professions such as law, however, is problematic.

Limitations

College origins and academic accomplishments within college appear to play crucial roles in becoming a physician. To this extent, the findings of the present study tend to support Tinto's (1980, 1981) hypothesis that college quality and academic success are more important in the explanation of status attainment in professional than in nonprofessional occupations. Because the study focuses on occupational attainment in a specific profession, however, and because this profession requires graduate training, it is likely that results in large measure reflect the ability of the model to explain successful or unsuccessful medical school admission. Thus, attendance at an elite undergraduate institution, majoring in a physical/life science, and high levels of collegiate academic achievement may increase the likelihood of becoming a physician, largely because they increase the likelihood of competing successfully for admission to medical school. However, once admitted to medical school approximately only 3% withdraw. Almost 97% attain the M.D. (Jones and Vanyur, 1984).

This may be only part of the explanation, however. For some students, variables in the model, such as collegiate academic achievement and whether or not they majored in a science, may reflect the maintenance, changing, or lowering of initial career aspirations. Some individuals initially aspiring to be physicians, for example, may lower their aspirations and even change their major, if they find they cannot compete in terms of the minimal academic performance required for admission to medical school. Unfortunately, with only one follow-up, the configuration of the CIRP data makes it nearly impossible to separate the effects of aspiration changes during college from failure to get into medical school.[6]

The study has other limitations. The data follow students only over a nine-year period from first enrollment as college freshmen. Consequently, while we can determine who becomes a physician, we cannot determine the effects of college, if any, on subsequent success within the profession. Similarly, the occupational categories provided by the data do not permit the possible explanation of differential statuses (i.e., specialties) within medicine. These are potentially important areas for future research.

A final, major limitation of the study is that it is based on a secondary analysis of existing data. This being the case, the data may have been collected for purposes quite different from those to which they were put in this investigation. Consequently, the operational definitions of several variables in the model were less than optimal. For example, the measure of interaction with faculty/staff was based on a single item and the measure of social leadership experiences was based on four items with a relatively low internal consistency reliability (i.e., .46). Stronger measures of these two variables

may have enhanced their influence in the model and changed the results of the study.

NOTES

1. Since the study focuses largely on the subsequent occupational attainment of students who aspired to become physicians at entrance to college, precollege occupational aspirations were essentially held constant. The only exception to this was an additional small group of students who became physicians even though that was not their precollege aspiration. Controlling for precollege aspiration with such a sample would have yielded a negative correlation between precollege aspiration and actually becoming a physician. Since this made little conceptual sense, and since inclusion of precollege aspiration had no effect on the results, it is not included in the model specification.
2. A very small number of individuals indicated that they had not obtained the M.D. degree as of 1980, but were still actively pursuing it. These individuals were dropped from the analysis.
3. Because of the possibility of selective, nonrepresentative response on the follow-up survey, the CIRP data contain a weighting algorithm to adjust for response bias. All analyses reported in the paper are based on weighted sample estimates adjusted to actual sample size to obtain correct degrees of freedom. Parallel sets of analyses were conducted with weighted and unweighted samples. Although there were only trivial differences in the results, the weighted estimates are reported.
4. Because of the dichotomous nature of the dependent variable, the direct effects results for all equations were reestimated with a log-linear analysis. This analysis fits the logistic regression model to binary dependent measure. The results of this analysis yielded coefficients that differed only slightly in relative magnitude, and not at all in statistical significance, from the ordinary least-squares regression results.
5. In response to one anonymous reviewer, we also analyzed the data to determine the factors influencing becoming a physician for all CIRP sample members who attended only one undergraduate institution ($N = 4,590$). Since only about 2% of the sample actually became physicians, we conducted a logistic regression analysis instead of ordinary least-squares regression (Goodman, 1976). This prevented us from using the Gemini program to compute and determine the significance of indirect effects. Thus, we will only report direct effects. The entire model, including a precollege measure of aspiration, explained 16.56% of the variance in becoming a physician. After precollege aspiration, which had the largest positive direct effect, the only other variables having significant (at $<.001$) direct effects were: being a science major, collegiate academic achievement, institutional selectivity/prestige and having either parent be a physician. These results are quite similar to analyses on the more focused sample. Additionally there was a significant institutional selectivity/prestige × collegiate academic achievement interaction, which was essentially the same as that found in the main analyses.
6. Of the 350 students who did not become physicians, 55 (15.7%) were in occupations related to the medical field (e.g., dentistry, nursing, optometry, pharmacy, scientific research), while 35 (10%) were in occupations of approximately equal status to that of physician according to the Duncan scale (Featherman and Stevens, 1982). These included: architecture, college professor, law, and engineering. The remaining individuals were in occupations generally lower on the Duncan scale.

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