

SECTION III

REGULAR AND SPECIAL FEATURES

MD-PhD Students in a Major Training Program Show Strong Interest in Becoming Surgeon-Scientists

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A wide spectrum of individuals have discussed the importance of promoting research in orthopaedics and of developing clinician-scientists (physicians who also do significant research) in the field. Although orthopaedic research may benefit from recruitment of MD-PhD students as clinician-scientists, it is unclear to what extent MD-PhD students are interested in pursuing research and surgical specialties concurrently. To better understand their professional goals, all MD-PhD students enrolled in our institution's training program were invited to complete an online questionnaire concerning training satisfaction and future career goals. Twenty-four percent of respondents (57.5% response rate of 167 recruits) reported a primary clinical interest in a surgical field (3% interest in orthopaedics); interest was strongest late in training. The majority of surgical MD-PhD students, like nonsurgical students, were planning to make research a significant part of their careers. In addition, students identified the importance of factors such as family issues and faculty role models in determining their clinical interests. The study data indicate that MD-PhD students have strong interests in becoming surgical clinician-scientists. They also suggested that active recruitment (especially early in training) that is responsive to the personal and professional needs of students has the potential to increase the number of clinician-scientists in orthopaedics.

As early as 1979, James Wyngaarden, former director of the National Institutes of Health, warned that clinician-investigators (physicians who do research) would become an endangered species.^{2,3} More than 20 years later, numerous leaders in medicine agree that the current decline in the number of new clinician-scientists must be reversed if we are to avoid a critical shortage.^{3,7–9,12,17,18,20} Orthopaedic surgeons have recognized a relative dearth of clinician-scientists in the field and have discussed the importance of promoting more research in orthopaedics.^{2,5–7,14,15,22}

To increase the number of clinician-scientists, the National Institute of General Medical Sciences has increasingly supported funding of MD-PhD or Medical Scientist Training programs.¹¹ Numerous postgraduate analyses show that trainees of combined MD-PhD programs have experienced academic success.^{1,4,10,11,16,19} However, one study indicated that a disproportionately small number of graduates from Medical Scientist Training programs from 1964–1994 went on to a career in orthopaedics in particular, and careers in surgical fields in general.⁶

Although it is unclear why MD-PhD students choose not to enter certain specialties, these data suggest that surgical fields may need to recruit more vigorously to attract and retain interested students. Orthopaedics has much to gain by such efforts because clinician-scientists are relatively rare in the field.^{2,6} However, it is unclear how much of an interest MD-PhD students currently have in pursuing surgical specialties in general, and orthopaedics in particular. With the assumption that a better understanding of current student desires and goals will lead to better recruitment efforts, we examined a survey of MD-PhD students at our institution to see how much interest students have in pursuing surgical careers. We also attempted to determine

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at what stage in their training students develop these interests, if surgically oriented students are interested in being clinician-scientists, and the importance of various factors in deciding primary clinical interests.

MATERIALS AND METHODS

The study was approved by the IRB of our institution and consisted of an online survey (Appendix) that was completed anonymously. The survey consisted of multiple-choice questions addressing the topics of (1) satisfaction with the MD-PhD education; (2) attitudes concerning the physician-scientist model; and (3) future goals and aspirations. After three group invitations and one individualized invitation (through e-mail), the response rate was 57.5% (96 responders of 167) of all students currently enrolled in the MD-PhD program at our institution. One responder who indicated a preference for no medical residency was not included in this analysis. Statistical significance between subsets of responders was determined using the chi square test, and *p* values are reported.

As a proxy measurement of nonresponder bias, the responder and nonresponder groups were compared on the demographic parameters of age (mean age, 27.0 and 26.6 years respectively; *p* = 0.280, two-tailed *t* test), gender (58 of 96 and 45 of 70 were males respectively; *p* = 0.612, chi square test), years since matriculation (4.3 and 4.8 years respectively; *p* = 0.125, two-tailed *t* test), and funding status (56 of 96 and 37 of 70, respectively, were fully funded with the remainder having partial funding; *p* = 0.483, chi square test).

RESULTS

Twenty-four percent of responding students (23 of 95 responders) had a primary clinical interest in the surgical fields of general surgery, neurosurgery, obstetrics and gynecology, ophthalmology, orthopaedic surgery, and otolaryngology (Table 1), and will be referred to as surgical students. Three students (of 95) were interested in orthopaedic surgery (Table 1) and have matched in orthopaedics in the 2003 match. Two PhD-level students indicated that orthopaedics was a secondary clinical interest. Students in the program typically begin medical school (2 years), begin and complete their PhD (3–5 years), and then finish the

clinical requirements of their MD degree at the end of the program (2 years).

The 23 responding surgical students rated the importance (extremely important, moderately important, minimally important, or not important) of numerous factors leading them to their primary clinical interest. The five factors ranking highest in importance for surgical students were: (1) interest in the clinical subject matter; (2) interest in types of procedures; (3) personal or family issues; (4) gut feeling; and (5) clinical role models (Table 2). The five factors ranking lowest were prestige; ease of obtaining a residency position; matching patterns at the student's school; opinions of other students; and a need for more clinicians in a field (Table 2).

A comparison of surgical students and nonsurgical students (72 students interested in fields that are not primarily surgical) revealed that the two groups are similar (Table 2). Surgical and nonsurgical students are comparably satisfied (very or somewhat satisfied) with their education (100% and 87.3%, respectively; *p* = 0.27) and are similarly represented by female (35% and 40%, respectively; *p* = 0.64) and minority (9% and 13%, respectively; *p* = 0.62) students.

Despite the observation that MD-PhD recipients in surgical fields frequently seem to leave research after they begin clinical practice,⁶ a surprisingly low percentage (13%) of surgical students reported that they were not going to become physician scientists. This value was similar to that of the nonsurgical students (10%; *p* > 0.5). Furthermore, 52.2% of the surgical respondents wanted research to be their future primary or secondary career activity (34.8% primary and 17.4% secondary); 80% of those who chose clinical work as the primary activity wanted research as their secondary career activity. These data suggest a strong interest among MD-PhD students, even those headed toward surgical fields, to become clinician-scientists.

DISCUSSION

MD-PhD students represent a significant pool of future clinician-scientists and their recruitment into orthopaedics has the potential to benefit research in the field. This study was done with the goal of understanding the surgical interests of MD-PhD students so that they may be better encouraged to pursue surgical specialties such as orthopaedics.

The level of interest in surgical fields by MD-PhD students (24%) shown in this study is contrary to the common notion and previous data that MD-PhD students have little interest in pursuing postgraduate surgical training (12.4% of all MD-PhD recipients in practice examined in one study⁶). Furthermore, the data suggest that surgical MD-PhD students are interested in pursuing research during

TABLE 1. MD-PhD Student Clinical Interests

Field of Interest (by decreasing frequency)	% of 95 Responders
1. Otolaryngology	6
2. Obstetrics and gynecology	5
3. Ophthalmology	4
4. Orthopaedic surgery	3
4. General surgery	3
6. Neurosurgery	2
7. Urology	0
7. Plastic surgery	0

TABLE 2. Importance of Factors in Deciding Clinical Interest of Surgical MD-PhD Students

Rank	Influencing Factor	% Reported as Extremely Important
1.	Interest in clinical subject matter	70
2.	Procedures performed	61
3.	Personal or family issues	57
4.	Gut feeling	48
4.	Faculty or role models in clinical settings	48
6.	Hours worked	35
6.	Field or type of research interest	35
8.	Protected time for academic activities	30
9.	Earning potential	22
10.	Residency program length	18
10.	Social dynamics of the field	18
10.	Faculty/role models outside clinical setting	18
10.	Availability of funding for academic activities	18
10.	Need for more physician-scientists in a field	18
10.	Opinions of mentors	18
16.	Prestige	4
16.	Ease of obtaining a residency position	4
16.	Matching patterns of students at your school	4
19.	Opinions of other students	0
19.	Need for more clinicians in a field	0

their careers as much as their nonsurgical counterparts. By most parameters, surgical MD-PhD students were not as disparate from their nonsurgical counterparts as might have been speculated (Table 3). The main difference was that a greater proportion of surgical students (43% versus 17% of nonsurgical; $p < 0.01$) had completed their PhD and had returned to clinical rotations (Table 2); students tend to develop surgical interests later during medical school than they do nonsurgical interests. This is not an unexpected finding because students typically do not receive much surgical exposure in the early years of medical school or during graduate school.

The shortage of MD-PhD physician-scientists in surgical fields, therefore, may reflect one of two realities: (1) our current cross section reflects a population of students different from physicians who now are practicing and that in the next 10–15 years, the number of MD-PhD physi-

cian-scientists in surgical fields will increase dramatically; (2) the more likely scenario is that the strong level of interest developed during clinical undergraduate medical training is lost in translation to postgraduate practice. To increase the number of MD-PhD graduates who become physician-scientists in practice in surgical fields, initial student interest must be nurtured and supported.

How can orthopaedics attract more MD-PhD students? Residency programs could make efforts to be more understanding of and flexible toward family issues because MD-PhD students tend to be older and more likely to have started their families. The rank list of factors in deciding clinical direction (Table 2) stresses the importance of exposure to clinical role models and to information regarding orthopaedics as a field and career choice; orthopaedists need to share their excitement about the field with students. This enthusiasm needs to be shared with senior students, but perhaps more importantly, with junior students who have not yet developed strong interests in surgical fields. The lower ranking of field or type of research interest on the list (Table 3) suggests that students are willing to tackle various problems and do not feel restricted to their PhD topics. In other words, they may consider research in the musculoskeletal system (a system not often the topic of PhD dissertations) independent of their specific thesis topic during doctoral training. The presence of earning potential, residency program length, and hours worked lower on the list (Table 3) indicates that perhaps lifestyle issues are not critical internal barriers for these students.

TABLE 3. MD-PhD Student Demographics

Parameter	Nonsurgical	Surgical	p Value
Age (mean value in years \pm 1 S.D.)	26 \pm 2.5	27 \pm 1.7	n/a
Underrepresented minority	13%	9%	0.62
Female	40%	35%	0.64
PhD completed	17%	43%	0.008
Students reporting overall satisfaction with MD-PhD program	87.3%	100.0%	0.27

A particular subpopulation that needs to be targeted (as is true with nonMD-PhD students) is women. Although the overall percentage of women among surgical students (35%) was similar ($p > 0.5$) to that of nonsurgical students (40%; Table 2), none of these women indicated an interest in orthopaedics. Recruitment of women into orthopaedics, with and without research interests, is an important issue.^{3,13,21}

The conclusions offered by this study should be considered within the context of its limitations. The response rate, although adequate, was not high enough to confidently exclude significant nonresponder bias. To better address this issue, a comparison of demographic data between responders and nonresponders was done; the results indicated no significant differences between the two populations on the parameters examined (see Materials and Methods). Also, the survey did not randomly sample from all MD-PhD students, and it is a one-institution study. Our institution's training program is one of the largest in the nation (largest program in a recent survey of MD-PhD program directors was 182; unpublished data. Presented at the Directors Meeting of the 2002 National MD-PhD Student Conference, Aspen, CO), and the graduates of our program have shown similar patterns of clinical interest

and professional activities as graduates from other programs.^{1,4,10,16,19} However, we cannot accurately generalize the results to all MD-PhD students because detailed data on students currently in training are unpublished. To overcome some of these limitations, we are doing a survey of 15 MD-PhD programs nationwide, and in that study, a formal nonresponder bias analysis will be done.

Nevertheless, these data suggest that there is significant surgical interest among MD-PhD students (especially late in their training), that the research interest of these students is strong, and that they have not committed their clinical interests based on their PhD research topics. We think that the number of physician-scientists in orthopaedics and other surgical fields can be increased successfully through better understanding of MD-PhD student attitudes and desires and implementation of supportive policies and programs based on that understanding.

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Appendix

Combined Degree Student Questionnaire				
Demographics and Status of Training				
1 What is your current age:				
2 What is your sex:	Male	Female		
3 Do you consider yourself a member of an underrepresented minority group in medicine:	Yes	No		
4 Do you currently have a spouse/partner:	Yes	No		
5 Do you have any children:	Yes	No		
6 Which of the following best describes your pre-clerkship medical school training (e.g. courses in basic sciences, pharmacology, pathology, etc.):				
A. Not Started				
B. Started but not completed				
C. Completed				
7 Which of the following most accurately describes your clinical medical school training (e.g. required clerkships and clinical electives):				
A. Not Started				
B. Started but not completed				
C. Completed				
8 Which of the following most accurately describes your non-thesis graduate school training (e.g. classes, lab rotations, etc.):				
A. Not Started				
B. Started but not completed				
C. Completed				
9 Which of the following most accurately describes your thesis graduate school training:				
A. Not Started				
B. Started but not completed				
C. Completed				
10 Are you in the matching/final year of your MD/PhD program:	Yes	No		
11 What best describes the field of your thesis research:	▼			
12 Please indicate the year you graduated from college:				
13 Did you participate in a year or more of full time research prior to starting your MD/PhD program:	Yes	No		
14 Please indicate the year you started your MD/PhD program:				
15 Please indicate the year you expect to graduate from your MD/PhD program:				
16 The length of time devoted to clinical education in your MD/PhD program is:	Too Short	Just Right	Too Long	No Opinion
17 The length of time devoted to research education in your MD/PhD program is:	Too Short	Just Right	Too Long	No Opinion
18 Which of the following best described your entire funding package for your MD/PhD program:				
A. Full funding				
B. Partial funding				
C. None				
19 Your expected indebtedness from all educational loans upon completion of your MD/PhD program:				
A. None				
B. \$1 - \$49,999				
C. \$50,000 - \$100,000				
D. >\$100,000				

Possible Answers for Question 11

- Anatomy
- Biochemistry
- Bioengineering
- Biophysics
- Cellular and Molecular Biology
- Epidemiology and Public Health
- Genetics
- Health Care Economics
- Immunology
- Microbiology
- Neuroscience
- Pathology
- Pharmacology
- Physiology
- Other (Not Listed)
- Currently Undecided

Educational Experiences

20 Considering all of your experiences thus far in the MD/PhD program, rate your degree of satisfaction with each of the following:

A Faculty advising			
B Peer advising			
C PhD education			
D Pre-clerkship medical school education			
E Clinical medical school education			
F Coordination between the MD and the PhD graduate programs			
G Activities designed specifically for MD/PhD students			
H Amount of information provided about choosing and applying to residencies			
I Amount of information provided on how to obtain grants/extramural funding as an MD/PhD student			
J Amount of information provided on how to obtain grants/extramural funding in your future career			
K Amount of information provided about various career options for an MD/PhD			
L Your overall satisfaction with your MD/PhD program			

21 How satisfied are you with your ability to recognize clinical problems that can be approached scientifically:

22 Have you ever seriously considered leaving your MD/PhD Program: **Yes** **No**

23 Has pressure to complete your MD/PhD program in a defined period ever adversely affected your educational experience: **Yes** **No**

Possible Answers to Question 20

Very Satisfied
Somewhat Satisfied
Neutral
Somewhatly Unsatisfied
Very Unsatisfied
Not Applicable

Possible Answers to Question 21

Very Satisfied
Somewhat Satisfied
Neutral
Somewhatly Unsatisfied
Very Unsatisfied

Attitudes and Views on Being a Physician-Scientist

24 Assuming the following definition, rate your extent of agreement or disagreement with the statements below:

A physician-scientist holds at least an MD and performs research as his/her primary professional activity.

A The majority of physician-scientists are MD/PhDs		
B I intend to become a physician-scientist		
C The primary goal of a physician-scientist should be to bridge the gaps between basic research and clinical medicine		
D The purpose of MD/PhD programs should be to train MDs who perform research as their primary professional activity		
E Job opportunities for physician-scientists appear promising		
F An MD/PhD graduate should become a physician-scientist		
G The number of physician-scientists being trained needs to increase		
H MD/PhD programs are the best way to train future physician-scientists		
I Do you agree with the provided definition of a physician-scientist		

25 Consider the following statements and then rate your extent of agreement or disagreement:

A Being "successful" as a researcher requires more than 50% of one's professional time

B Being "successful" as a clinician requires more than 50% of one's professional time

Possible Answers to Question 24 (A to B)

Agree
Not Sure
Disagree

Possible Answers to Question 24 (C to I)

Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

Possible Answers to Question 25

Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

Professional Goals

26 Please choose the options that best characterize your **current** career goals:

A Types of institutions where you would most like to obtain a position: **Most Desirable** **Second Most Desirable**

B Types of professional activities you would most like to engage in: **Primary Activity** **Secondary Activity**

C Types of research you would most like to engage in: **Most Likely** **Second Most Likely**

Possible Answers to Question 26 A

Academic Medical Center
Hospital or Clinic
Private Industry
Research Institute
Government
Other
None Chosen

Possible Answers to Question 26 B

Patient Care
Research
Teaching
Administration
Policy
Other
None Chosen

Possible Answers to Question 26 C

Basic Science
Disease Oriented
Patient Oriented
Clinical or Epidemiological
Other (Not Listed)
No Research

27 Rank in order of preference the three medical specialties you are most interested in or have been interested in:

First Choice Second Choice Third choice

28 Please indicate the extent of your interest for your choices above:

First Choice Second Choice Third choice

29 Please rate the importance of the following factors in determining **your** medical specialty interests expressed above:

<input type="checkbox"/>	Gut feeling
<input type="checkbox"/>	Interest in clinical subject matter
<input type="checkbox"/>	Field or type of research interest
<input type="checkbox"/>	Procedures performed
<input type="checkbox"/>	Hours worked
<input type="checkbox"/>	Personal/family issues
<input type="checkbox"/>	Earning potential
<input type="checkbox"/>	Prestige
<input type="checkbox"/>	Social dynamics of the field
<input type="checkbox"/>	Residency program length
<input type="checkbox"/>	Ease of obtaining a residency position
<input type="checkbox"/>	Perceived need for more clinicians in a particular field
<input type="checkbox"/>	Perceived need for more physician-scientists in a particular field
<input type="checkbox"/>	Availability of funding for academic (research, teaching, administration) activities
<input type="checkbox"/>	Protected time for academic (research, teaching, administration) activities
<input type="checkbox"/>	Opinions of mentors
<input type="checkbox"/>	Opinions of other students
<input type="checkbox"/>	Matching patterns of students at your medical school
<input type="checkbox"/>	Exposure to faculty/role models from a particular field in a clinical settings (e.g., the operating room)
<input type="checkbox"/>	Exposure to faculty/role models from a particular field outside of a clinical setting (e.g., the classroom or interest groups)

30 Comments about the best features of your MD/PhD program:

31 Comments/suggestions to improve the MD/PhD training process:

Possible Answers to Question 27	
<input type="checkbox"/>	Anesthesia
<input type="checkbox"/>	Dermatology
<input type="checkbox"/>	Emergency Medicine
<input type="checkbox"/>	ENT
<input type="checkbox"/>	Family Medicine
<input type="checkbox"/>	General Surgery
<input type="checkbox"/>	Internal Medicine
<input type="checkbox"/>	Neurology
<input type="checkbox"/>	Neurosurgery
<input type="checkbox"/>	OB/Gyn
<input type="checkbox"/>	Ophthalmology
<input type="checkbox"/>	Orthopaedic Surgery
<input type="checkbox"/>	Pathology
<input type="checkbox"/>	Pediatrics
<input type="checkbox"/>	Plastic Surgery
<input type="checkbox"/>	Psychiatry
<input type="checkbox"/>	Radiation Oncology
<input type="checkbox"/>	Radiology
<input type="checkbox"/>	Rehabilitation
<input type="checkbox"/>	Urology
<input type="checkbox"/>	Other Residency (Not Listed)
<input type="checkbox"/>	No Residency
Possible Answers to Question 28	
<input type="checkbox"/>	Extremely Interested
<input type="checkbox"/>	Moderately Interested
<input type="checkbox"/>	Somewhat Interested
<input type="checkbox"/>	Not Interested
Possible Answers to Question 29	
<input type="checkbox"/>	Extremely Important
<input type="checkbox"/>	Moderately Important
<input type="checkbox"/>	Minimally Important
<input type="checkbox"/>	Not Important

Appendix (Continued)

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