

## APM Perspectives

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# Publications by Students Doing a Year of Full-Time Research: What Are Realistic Expectations?

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Despite large increases in funding for biomedical research, surveys of matriculating medical students from 1985 to 1997 showed a decline in their expectation of being involved in research during their medical careers.<sup>1</sup> Nathan and Varmus cited the decrease in medical students choosing research careers as a factor contributing to the diminishing pool of physician-scientists conducting clinical research.<sup>2</sup> Concern about this trend led to the creation of 1-year medical student research fellowships, such as the Clinical Research Training Program (CRTP) at the National Institutes for Health (NIH) and the Doris Duke Clinical Research Fellowship (DDCRF), that would offer students a research experience, hopefully stimulating interest in clinical research careers and reversing the decline in clinician-scientists.

NIH CRTP was created in 1997 to provide medical and dental students a structured opportunity to conduct clinical research and to learn how the findings from basic research projects could be translated into advances in the prevention, diagnosis, and therapy of disease. DDCRF was initiated in 2000. The goals of this program are similar to those of CRTP, but participants carry out their research with faculty mentors at 1 of 12 medical schools or an affiliated international site that has been awarded a grant to support the program.

Many students enter these programs assuming that their year of research will result in a publication. Perhaps more importantly, they have the perception that residency and fellowship directors have similar expecta-

tations. Although experienced investigators might realize it is often impossible to complete, write up, and publish clinical projects shortly after the research year, students and program directors who have not done clinical research might not be aware of this limitation. Failure to meet personal goals can lead to disappointment and stress, negating the many other benefits offered by the programs. To establish reasonable expectations regarding publication after a year of research during medical school, we documented the publication rates of students in these programs.

## METHODS

CRTP fellows are selected through a competitive application process. During their participation in the program, they live on the NIH campus in Bethesda, Md. A senior physician-scientist serves as the fellow's advisor and helps to identify a mentor in his or her area of interest. One year of clinical rotations is a prerequisite for applicants to maximize the fellow's ability to understand the link between clinical research and medicine. Participation is thus restricted to individuals who have completed their third year. Each fellow carries out a clinical research project supervised by a mentor, sees patients in the inpatient and outpatient setting, participates in a journal club, and takes the Introduction to the Principles and Practice of Clinical Research course. Fellows also attend seminars given by local and guest faculty and can participate in courses by the Foundation for Advanced Education in the Sciences. At the end of the program, fellows present the results of their research at a conference.

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The DDCRF program also provides fellows with a mentored research experience and has a didactic component. It is offered by 12 medical school grant recipients: Columbia University College of Physicians and Surgeons; Harvard Medical School; University of California, San Francisco, School of Medicine; University of Iowa Carver College of Medicine; University of North Carolina School of Medicine; University of Texas Southwestern Medical School at Dallas; Washington University School of Medicine; Mount Sinai School of Medicine; University of Pennsylvania School of Medicine; Yale University School of Medicine; Johns Hopkins School of Medicine; and University of Pittsburgh School of Medicine. During the first 3 years of the program, more than one-half of the fellows completed the fellowship at their home institution. Most individuals participated after completing their third year of medical school, but students are eligible to apply after their second year. A small number of students participated after their fourth year. Each site is required to host a minimum of 5 fellows per year, although many programs identify additional funding sources resulting in variable numbers of fellows per program. To broaden student diversity and medical school participation, at least 2 fellowships must be awarded to medical students matriculated at schools other than the host institutions. Although fundamental similarities exist among sites, the structures of the individual programs are established by each institution so that there are also distinct differences. Among these differences are the amount of time devoted to the didactic component of the program, the

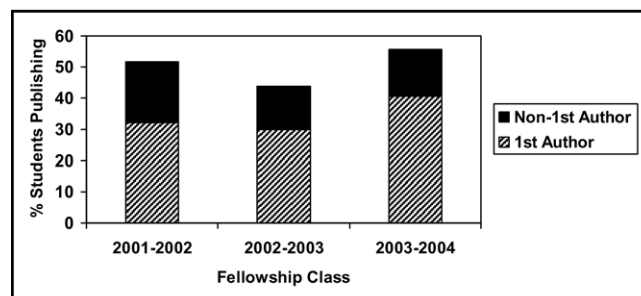
required courses, the process of project and mentor selection, and the choice of enrichment activities. The foundation does not support animal-based studies and all projects must meet the NIH definition of clinical research. At the end of each fellowship year, fellows present the results of their research at a national meeting.<sup>3</sup>

Data were collected only for those years when both programs were in existence (2001-2004). Names of the 217 fellows and the mentors who participated in the programs were collected from the program websites with permission from the programs. PubMed was used to track publications resulting from research carried out during these 1-year fellowships. Data collected included authorship (first or non-first), publication type (case report, review article, or original research article), and publication date (collected at 6 months and 18 months post-fellowship). To ensure accuracy of the data, multiple search terms were used (first and last name of fellow and mentor, research institution, zip code of research institution, and listed topic area), submission dates documented, and manuscripts examined for acknowledgement of the research fellowship.

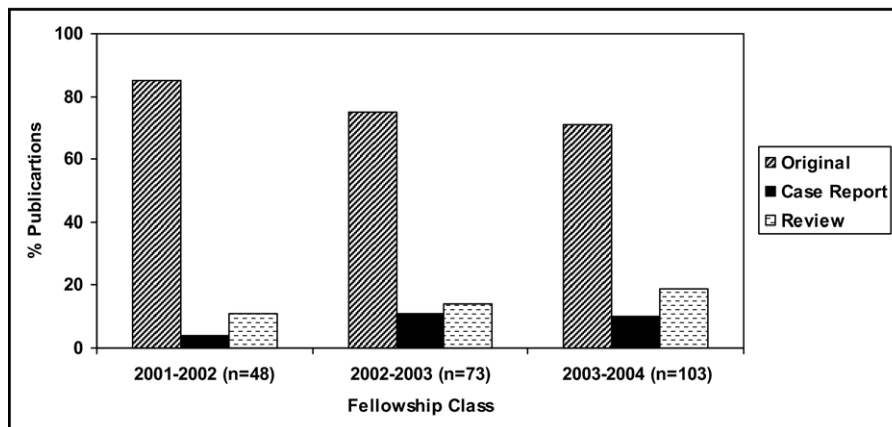
If there was a question about whether a publication resulted from research done during the fellowship period, the e-mail address of the author was obtained from the program and the fellow was contacted directly. Thirty-nine fellows were contacted by e-mail because of questions pertaining to their publications. Nineteen publications were excluded from the study findings because we could not confirm that they resulted from work performed during the fellowship year. Because 5 of the publications in question were the only paper for that particular fellow, our approach was conservative, which likely means that the results are a slight underestimate of the true publication rates of fellows participating in the 2 programs.

## PERSPECTIVES VIEWPOINTS

- NIH Clinical Research Training Program and the Doris Duke Clinical Research Fellowship were developed to stimulate medical student interest in physician-scientist careers.
- Students completing this kind of research are unlikely to be able to publish research results prior to residency interviews.
- Students, residents, and program directors need to establish reasonable expectations about publications after a year-long clinical research fellowship.



**Figure 1** Percentage of fellows publishing by 18 months post-fellowship.



**Figure 2** Publication types at 18 months post-fellowship by fellowship year.

There were no significant differences in the publication rates between the 2 programs at either 6 or 18 months ( $X^2 = 0.625$ ,  $P = .429$ ) and the data for each program were combined and grouped by year (ie, 2001-2002) for analysis.

This project was determined to be exempt from Mount Sinai Institutional Review Board (IRB) assessment.

### HOW MANY PARTICIPATING FELLOWS PUBLISH THEIR WORK?

First, we established the number of publications by program participants 18 months after completion of the research year, a time point that we felt would have allowed most of the fellows who intended to publish their results sufficient time to submit a manuscript and receive a response. Between 2001 and 2004, 217 fellows completing CRTP or DDCRF, generated 224 publications. Fifty-one percent ( $n = 109$ ) of the fellows from the classes of 2001-2002, 2002-2003 and 2003-2004 published at least 1 paper (Figure 1). Fellows were the first authors on 68% of the total publications,

suggesting that the majority worked on their own projects.

Successful completion of original research studies is dependent upon multiple factors, some of which the investigator might not control, eg, patient accrual, IRB approval, or reagent availability. Because fellows can have more success publishing a case report or review paper, in addition to documenting the number of original research publications, we also documented the number of case reports and review papers. The results revealed that 77% of papers published at 18 months were original research studies, 8% were case reports, and 15% were review articles (Figure 2).

### WHEN DO FELLOWS BEGIN TO PUBLISH?

The majority of students participate in CRTP or DDCRF following their third year of medical school and therefore interview for residencies within 6 months of completing their research fellowship. However, only 32% of the 224 articles in print at 18 months appeared within 6 months of completing the fellowship. Overall,



**Figure 3** Percentage of fellows with at least 1 publication 6 months post-fellowship.

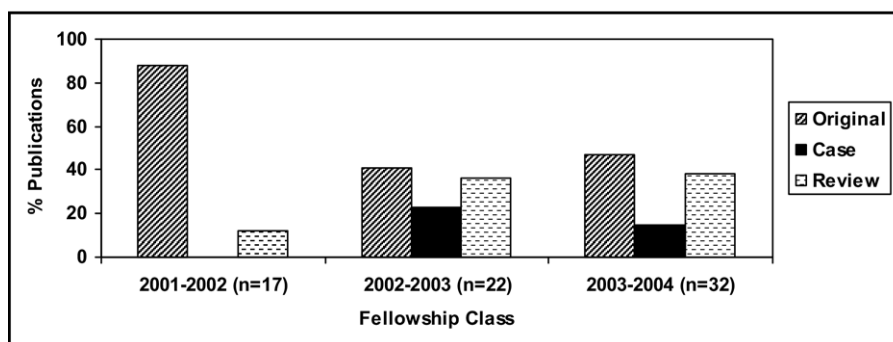


Figure 4 Publication types at 6 months post-fellowship by fellowship year.

only 23% of fellows had at least 1 publication by 6 months post-fellowship of which 58% of publications were first authorship (Figure 3). Therefore, most (approximately two-thirds) of the fellows will not have a publication at the time of residency interviews and only 13% will have a first author publication by that time.

Perhaps to compensate for the lag in generating original publications, a higher percentage of the publications at the 6-month point were case reports and review articles, compared with the 18-month point. At 6 months, original research studies accounted for 59% of the publications, with 13% case reports and 29% review articles (Figure 4). The difference between the percent of each publication type at 6 months and 18 months was significant for original articles ( $\chi^2 = .0009$ ) and review articles ( $\chi^2 = .0043$ ), but not case reports ( $\chi^2 = .213$ ).

## CONCLUSIONS

Recent data have shown that medical students completing 1-year research fellowships were more successful at obtaining post-doctoral funding and a faculty position which included a research component.<sup>4,5</sup> CRTP and DDCRF were created to enable more students to have a research experience, hopefully increasing the number of physician-scientists conducting basic or clinical research. As the programs become better known, it is likely that greater numbers of students will apply. Many of them will expect to publish their results. However, 1 year is a short time to complete a clinical research project. Moreover, results from an anonymous survey given by DDCRF to research fellows toward the completion of the program indicated that 18% of fellows did not feel their research question was well suited to the time available.<sup>3</sup> Failure to meet unrealistic expectations might cause students to develop unnecessary stress, which can detract from the other benefits of these 1-year fellowships. Additionally, residency and fellowship directors can have unrealistic expectations about student's abilities to publish after devoting a year

to a research fellowship. Our study demonstrated that more than 50% of fellows who participated in CRTP and DDCRF from 2001-2004 published within 18 months of completing their research year (Figure 1). However, because the majority of students do research years between their third and fourth years of medical school and because applications to residency programs are submitted from September to December of the students' fourth year, only publications in print by the 6-month mark could be included in their applications. The data revealed that only 23% of fellows participating in CRTP or DDCRF had a publication in print by 6 months post-fellowship (Figure 3). An even smaller percentage of fellows had a first author publication at this time point.

The findings suggest that, if the programs studied are representative, it is not realistic to believe that most students participating in 1-year clinical research programs will have a publication by the time they apply for residency positions. This information should allow participating students to focus on the other benefits of the programs. It also might help program directors to develop more informed standards for reasonable expectations of productivity for these programs.

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