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Outcomes of mentored, grant-funded fellowship training in haemostasis /thrombosis: findings from a nested case–control survey study

N. A. GOLDENBERG,*[1] R. KRUSE-JARRES,†[1] N. FRICK,‡ S. W. PIPE,§ C. A. LEISSINGER† and C. M. KESSLER¶

**Section of Hematology/Oncology/Bone Marrow Transplantation and the Mountain States Regional Hemophilia and Thrombosis Center, Department of Pediatrics, University of Colorado, Aurora, CO; †Section of Hematology and Medical Oncology, Department of Medicine, The Louisiana Center for Bleeding and Clotting Disorders, Tulane University, New Orleans, LA; ‡National Hemophilia Foundation, New York, NY; §Division of Hematology/Oncology, Department of Pediatrics and Communicable Diseases, University of Michigan Health System and C.S. Mott Children's Hospital, Ann Arbor, MI; and ¶Section of Hematology and Hemophilia and Thrombophilia Center, Department of Medicine, Lombardi Comprehensive Cancer Center, Georgetown University, Washington, DC, USA*

Summary. Successful strategies by which to effectively recruit and retain academic subspecialists in benign haematology have not been established. To evaluate the effectiveness of a grant-funded, mentored fellowship with respect to retention and early career goals in haemostasis/thrombosis, we sought to compare outcomes for graduates of a grant-funded, mentored fellowship training programme in haemostasis/thrombosis [the National Hemophilia Foundation (NHF)-Baxter Clinical Fellowship Award] during conventional haematology/oncology fellowship training (cases), vs. their training peers who were graduates of conventional haematology/oncology fellowship training alone (controls), via a nested case-control survey study. Survey response rate was 85% (11/13) for cases and 90% (9/10) for controls. All respondents had pursued careers in academic haematology/oncology. Median (range) percent time spent in benign haematology postfellowship was 98% (70–100%) for cases vs. 0% (0–20%) for controls. Time spent in research was significantly greater among cases than controls (median 80% [range: 42–90%] vs. 55% [10–80%], respectively; $P = 0.01$). By years 3–4 postfellowship, median annual number of peer-reviewed publications was higher for cases than controls (3.5 vs. 1.0; $P = 0.01$). Cases were also more successful in grant funding (including K-awards). These data suggest that a grant-funded, mentored fellowship training programme in haemostasis/thrombosis may be superior to conventional haematology/oncology fellowship training alone with respect to outcomes of retention in clinical care/research, early-career grant funding and publication productivity.

Keywords: benign haematology, coagulation, fellowship, outcomes, training

Introduction

Successful strategies by which to effectively recruit, train and retain academic subspecialists in benign haematology remain unclear. In the UK, a particular challenge has been identified for transfusion medicine subspecialists [1], and throughout Europe and the United States for haemophilia treatment experts [2]. Innovative means of recruitment into training programmes have been deemed critical to the future of these areas and the academic haematology subspeciality in particular.

The National Hemophilia Foundation (NHF)-Baxter Clinical Fellowship Program, funded through an educational grant by Baxter Biosciences, was developed in 2002 to educate and train new physicians in comprehensive care and research for individuals with bleeding and clotting disorders. 'Centers of excellence' within the Centers for Disease Control and Prevention and Maternal and Child Health Bureau-established

Correspondence: Neil Goldenberg, MD, PhD, Mountain States Regional Hemophilia and Thrombosis Center, University of Colorado, P.O. Box 6507, Aurora, CO 80045-0507, USA.
Tel.: +303 724 7028; fax: +303 724 0078;
e-mail: neil.goldenberg@ucdenver.edu

[1] These authors contributed equally.

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Hemophilia Treatment Center network were selected as training sites for the Program following institutional application, based on the following criteria: (i) established haemophilia/thrombophilia treatment centre with both clinical and research faculty, (ii) affiliation with major universities and teaching hospitals, (iii) strong track record and future plan for haemostasis/thrombosis trainee recruitment, (iv) adequate patient base and volume in haemostasis/thrombosis, (v) institutional track record and resources for training, (vi) depth of research training opportunities, and (vii) development of a curriculum for education in: haemostasis; thrombosis; treatment of haemophilia, von Willebrand disease and other bleeding disorders; and treatment of thrombophilia and thrombotic diseases. Via a peer review process involving representatives of the NHF's Medical and Scientific Advisory Council, seventeen institutions were approved for the Program, based upon fulfilment of the aforementioned qualifications.

Approved institutions were subsequently invited to nominate trainee candidates. Candidates were selected for the NHF-Baxter Clinical Fellowship Award based upon the following criteria: (i) medical degree, (ii) eligibility for subspeciality board certification upon completion of the 2-year fellowship, (iii) United States citizenship or permanent resident status, (iv) qualifications and previous experience, (v) long-term goals, including desire to remain in the haemostasis/thrombosis field, and (vi) letters of recommendation provided by the haemophilia/thrombophilia treatment centre Medical Director and from other faculty within the institution. The mentorship plan was not prescribed in detail by the Program, but was comprised of the following elements: (i) direct clinical and research mentorship by an expert in haemostasis/thrombosis who has a leadership role in a haemophilia/thrombophilia treatment centre, (ii) regular mentorship interactions in clinical care, research and career development, and (iii) generation and NHF panel review of semi-annual progress reports addressing progress in clinical training, research and scientific presentations/publications.

The objectives of the present study were to compare outcomes of this grant-funded, mentored fellowship training program in haemostasis/thrombosis during conventional haematology/oncology fellowship training, vs. conventional haematology/oncology fellowship training alone, via a nested case–control survey study. In particular, we sought to evaluate retention into a benign haematology career, time spent in research, publication trajectory and grant funding success.

Materials and methods

Subjects and design

We conducted a nested case–control survey study involving NHF-Baxter program trainees (cases) and their contemporaneous institutional colleagues in haematology/oncology fellowship training (controls). A standardized survey was developed via a consensus process involving the authors, and then produced in web-based format. Prior to administration of the survey, cases were contacted with a request to provide (with permission) names and contact information for all controls for whom this information was available via their fellowship program, for the purposes of survey research. Trainees who had not yet completed fellowship were excluded. All cases and controls were then emailed a brief description of the study, along with a request to complete the survey via a link provided in the email, as well as to upload their current (i.e. up to date) curriculum vitae. To optimize response rates, personalized follow-up email reminders were sent to all subjects by one of the authors (NAG). The study was approved by the Tulane University Institutional Review Board, with waiver of written informed consent.

Data collection

Quantitative components of the survey used in the present analysis are shown in Fig. 1. Additional data fields from the curriculum vitae included number of publications and all grant funding amounts (measured in direct costs, excluding NHF-Baxter Clinical Fellowship Award funding); these data were reported for the 2-year period immediately preceding, the period during, the 2-year period immediately after, and years 3–4 after fellowship training. Further data collection from the curriculum vitae consisted of gender, current age and time (in years) postfellowship entry to gaining appointment as assistant professor and to obtaining a National Institutes of Health K08 or K23 award.

Statistical analyses

Descriptive statistics were used to define distributions of continuous variables and frequencies (i.e. proportions) of categorical variables. Continuous data were compared between case and control groups by Mann–Whitney *U*-test, and proportions were compared between groups via chi-squared test or Fisher's exact test, as appropriate based on cell frequencies in two-by-two tables. All hypothesis tests were two-tailed, with a *P*-value of less than 0.05 considered to be statistically significant. Statistical analyses employed SAS 9.1 software (SAS Institute, Cary, NC, USA).

Results

Survey response rate was 85% (11/13) for cases and 90% (9/10) for controls. Ninety per cent of respondents had trained in paediatric programmes. Distribution of cases and controls (respectively, by institution) was as follows:

1. In what year did you begin your clinical fellowship?

2. In what year did you end your clinical fellowship?

3. What is your current title(s)?

4. Upon completing your fellowship, what type of position did you take?

- Haematology research – basic
- Haematology research – clinical
- Oncology research – basic
- Oncology research – clinical
- Haematology – Teaching
- Haematology – Administration
- Oncology – Teaching
- Oncology – Administration
- Haematology – Other (explain)
- Oncology – Other (explain)

5. Since the completion of your fellowship, how much of your time has been allocated to the following? Please indicate up to 100%.

- Benign Haematology
- Malignant Haematology
- Solid Tumors
- Other: Please explain

6. Since the completion of your fellowship, how has your time been allocated? Please indicate up to 100%.

- Clinical
- Research- basic
- Research- clinical
- Teaching
- Administration
- Other (explain)

7. On a scale of 1 to 5, with 1 being the lowest, please rate your current level of knowledge for each of the following areas:

- Haemostasis
- Thrombosis
- Other benign haematology
- Transfusion medicine
- Coagulation laboratory technique/skills
- Clinical research
- Basic research methodologies

8. Please provide your current curriculum vitae, including all past and current grant funding.

Fig. 1. Survey questions used in the study analysis.

The Children's Hospital, University of Colorado (n = 2, n = 3); Children's Hospital of Philadelphia, University of Pennsylvania (n = 2, n = 2); Department of Pediatrics, University of Michigan (n = 2, n = 2); Department of Medicine, Tulane University (n = 1, n = 1); Michigan Children's Hospital, Wayne State University (n = 1, n = 1); Department of Pediatrics, University of Iowa (n = 1, n = 0); Children's Medical Center, Emory University (n = 1, n = 0); and Cincinnati Children's Hospital, University of Cincinnati (n = 1, n = 0).

Demographic data and outcomes (excluding publication and grant funding trajectories) are given in Table 1. Median (range) age at survey response was 39 years (33–46 years), and did not differ between case and control groups. Fifty per cent of respondents were women, with similar gender distribution between groups. All respondents had pursued careers in academic haematology/oncology. Median (range) per cent time spent in benign haematology postfellowship was 98% (70–100%) for cases vs. 0% (0–20%) for controls, and time spent in research was significantly greater among cases than controls (median 80% [range: 42–90%] vs. 55% [10–80%], respectively; P = 0.01).

Figure 2 displays peer-reviewed publication rates over time, comparing cases vs. controls. By years 3–4 postfellowship, median annual number of peer-

Table 1. Demographic characteristics and outcomes (excluding publication and grant funding trajectories, shown in Figs 1 and 2) of former NHF-Baxter trainees (cases) and contemporaneous institutional haematology/oncology fellowship trainees (controls).

Characteristics	Cases (n = 11)	Controls (n = 9)	P-value
Demographics			
Gender (female)	5 (45%)	5 (56%)	
Median (range) age at fellowship entry	39 years (33–43 years)	39 years (33–46 years)	
Outcomes postfellowship			
Median (range) time from fellowship entry to assistant professor (academic practice physicians only)	3.5 years (3–5 years)	7 years (6–8 years)	<0.001
Time spent in benign haematology	98% (70–100%)	0% (0–20%)	NA
Time spent in research	80% (42–90%)	55% (10–80%)	0.01
Attained NIH K23/K08 award within 5 years of fellowship entry	3/9 (33%)	0/8 (0%)	NE

NA, not appropriate for comparison (e.g. concern for selection bias); NE, not evaluable.

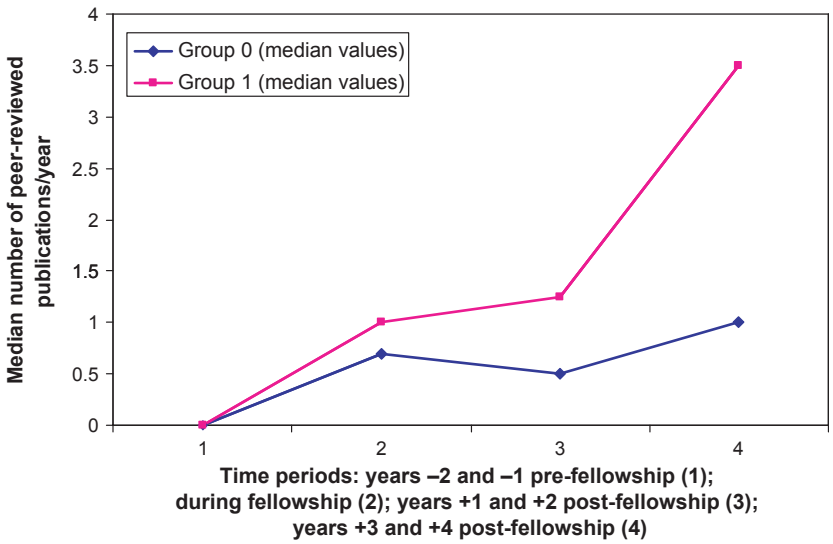

Fig. 2. Publication Trajectory for NHF/Baxter Fellowship Program Awardees (Group 1, n = 11) vs. Non-Awardee Institutional Hem/Onc Fellowship Program Peers (Group 0, n = 9).

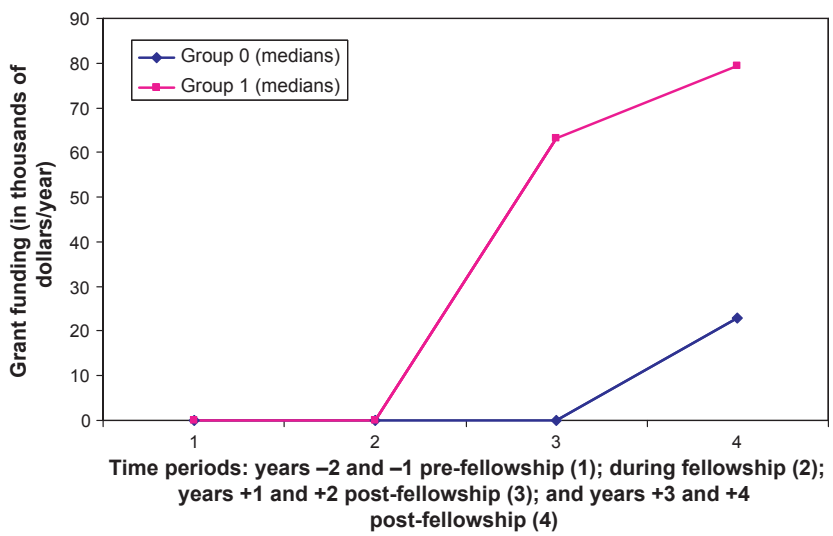

Fig. 3. Grant Funding Trajectory for NHF/Baxter Fellowship Program Awardees (Group 1, n = 11) vs. Institutional Hem/Onc Fellowship Peers (Group 0, n = 9).

reviewed publications was higher for cases than controls (3.5 vs. 1.0; P = 0.01). Figure 3 shows grant funding trajectory for cases vs. controls, in annualized direct costs, excluding NHF-Baxter Clinical Fellowship Award funding. Although not statistically significant, median annual grant dollars were appreciably higher among cases than controls ($80 000 vs. $23 000; P = 0.20), as was the percentage of individuals who obtained K awards within 5 years of beginning fellowship (33% vs. 0%; P = 0.21 [Table 1]).

Discussion

The findings of this nested case–control survey study suggest that a grant-funded, mentored fellowship training program in haemostasis/thrombosis may be superior to conventional haematology/oncology fellowship training with respect to retention of physicians in benign haematology clinical care and research, and academic outcome measures such as publication and grant funding trajectories. The study has important potential implications for future training in haemostasis/thrombosis and perhaps other specialities in benign haematology wherein recruitment and retention of physician-investigators has been deemed a critical challenge. Key enhancements of conventional fellowship training—specifically, grant-funding and mentorship in a particular area of subspeciality focus—likely serve as strong contributors to the comparative success of the grant-funded, mentored fellowship training programme. For this reason, the authors believe that future efforts at recruitment and retention of haemostasis/thrombosis physician-investigators should emphasize the development of grant-funded, mentored fellowship training programmes to augment conventional haematology/oncology training.

A national decline in academic subspecialists and trainees in benign haematology has been emphasized by the American Society of Hematology [3]. This trend is exacerbated by the economic disparity between academic and private practice physician salaries in haematology/oncology, the latter of which emphasizes competence in the management of malignant diseases. A survey study of adult haematology/oncology fellowship program directors revealed that only 24% of graduating trainees pursued an academic career [4]. Furthermore, a survey study of adult and paediatric haematology/oncology fellowship program directors demonstrated that benign haematology serves as the clinical focus for only 5–6% of adult training graduates in private practice or academia, and for less than 1% of paediatric graduates in private practice; by contrast, 13% of paediatric haematology/oncology training programme graduates who remained in academia pursued benign haematology as a clinical focus [5].

Various curricula for training and/or competence in benign haematology have been reported in the past several years. On behalf of the American Society of Pediatric Hematology/Oncology (ASPHO), Hastings and colleagues on the ASPHO Training Committee outlined goals and core components for paediatric haematology/oncology training. While both clinical and research training were emphasized, mechanisms for recruitment and retention in academic haematology/oncology were outside the scope of the Committee's report [6]. Astermark and group, for the European Association of Haemophilia and Allied Disorders, described detailed competencies for clinical practice in haemostasis/thrombosis, but strategies for recruitment and retention into the field were not among the aims of the consensus criteria [7]. Through a curriculum development effort funded by the American Society of Hematology, Abshire proposed criteria for clinical and research training in benign haematology within a 2-year adult Hematology fellowship program, which includes 3 months of inpatient benign haematology and 4–5 months of outpatient benign haematology in the first year, and 75% time in benign haematology research in the second year [8]. The research component emphasizes mentorship as well as a faculty oversight committee.

The present findings for successful retention and early career development in haemostasis/thrombosis build upon prior literature in the field, with particular regard to mentorship and training grant support in benign haematology. In a survey study among US adult hematology/oncology training programs, Gitlin and co-workers investigated prognostic factors for successful fellowship training towards a career as a physician-investigator in haematology/oncology. This study revealed that completion of a clinical research project, presence of a clinical research track/programme, availability of a formal research curriculum, mentorship with a faculty oversight committee and acquisition of independent career development grant funding were all independently associated with trainee pursuit of a clinical research career in haematology/oncology [9].

Consistent with our observations in the present work, a systematic review of 39 studies on the impact of mentorship revealed positive associations with mentee career choice, retention in academia and research productivity, including publication and grant funding [10]. 'Extensive mentorship' has also been emphasized as a key ingredient in curriculum guidelines for training in Haematology put forth by a subcommittee of the American Society of Hematology Committee on Training Programs, to supplement the basic structure for subspeciality training provided by the Accreditation Council on Graduate Medical Education [11]. Yet, adequate mentorship is not easy to achieve. As Kaushanski and Shattil noted in 2007 (and which remains equally if not more relevant in 2011), 'Now, more than ever, we are in need of outstanding mentors, but… all too often institutions do not reward mentoring' [12]. By targeting funds towards both trainees and their mentors, perhaps future grant-funded, mentored fellowship training programmes haemostasis/thrombosis can overcome a key institutional barrier to realizing the benefits of mentored training in a subspeciality at risk of attrition.

A few limitations of the present work are noteworthy. First, the possibility exists for selection bias, in that the award of an NHF-Baxter traineeship may serve as an *a priori* marker of academic success. However, this potential bias was largely overcome by the selection of controls who were contemporaneous peers matched by institutional training programmes. Furthermore, this

potential bias is also mitigated by the fact that no significant difference in grant funding and publication amounts were apparent between cases and controls in the immediate prefellowship period. Secondly, the study is challenged by a rather small sample size, rendering statistical estimates imprecise. For this reason, the findings are best described as preliminary, and warrant further investigation. Third, while we observed that time from beginning of fellowship training to acquisition of an Assistant Professor position was shorter among cases than controls, this potential marker of favourable outcome of the grant-funded, mentored training programme could alternatively be explained by greater funding availability and/or clinical demand for junior faculty positions in haemostasis/thrombosis than in other areas of haematology/oncology, upon completion of fellowship training (i.e. in lieu of Instructor positions). Fourth, our study and the Program both assume that grant-funded, mentored training in haemostasis/thrombosis during fellowship—as opposed to during a postfellowship Instructor period—is the appropriate alternative/comparator to haemostasis/thrombosis training during traditional haematology/oncology fellowship. An alternative training strategy for haemostasis/thrombosis is a postfellowship Instructorship during which mentored training could take place in this subspecialized area. However, given the challenges of recruitment and retention in haemostasis/thrombosis discussed previously, we favour the approach of earlier immersion in grant-funded, mentored training. Lastly, despite the success of the NHF-Baxter Program in trainee recruitment and retention, adult (as opposed to paediatric) trainees were few. Given the broader salary gap between oncology and haematology in Internal Medicine than Pediatrics, and the delay in focused benign haematology training in some adult programmes until the second year (at which time decisions regarding research focus are being made), larger measures will be necessary to boost recruitment and retention of trainees into clinical and research careers in adult benign haematology, including haemostasis/thrombosis. Notwithstanding these potential limitations, the results of this nested case–control survey study suggest that future efforts at recruitment and retention of physician-investigators in haemostasis/thrombosis should emphasize the development of grant-funded, mentored fellowship training programmes to augment conventional haematology/oncology training.

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Authorship

NAG designed the research, analysed data, drafted the manuscript, revised the manuscript and approved its submission for publication. RKJ designed the research, analysed data, drafted the manuscript, revised the manuscript and approved its submission for publication. NF revised the manuscript and approved its submission for publication. SWP designed the research, revised the manuscript and approved its submission for publication. CAL designed the research, revised the manuscript and approved its submission for publication. CMK designed the research, revised the manuscript and approved its submission for publication.

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