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Training Physician-Scientists: A Model for Integrating Research into Psychiatry Residency

Sudie E. Back, PhD, Sarah W. Book, MD, Alberto Santos, MD, and Kathleen T. Brady, MD, PhD

Medical University of South Carolina, Department of Psychiatry and Behavioral Sciences, Charleston, SC.

Abstract

OBJECTIVE—The number of physicians engaged in research careers has declined significantly over the past two decades. Physicians with in-depth experience and formal training in research design, development, implementation, statistical analysis, and interpretation of scientific information are a rarity.

METHODS—In response to this shortage, the Medical University of South Carolina (MUSC) launched an NIH-funded research track in 2006 to address the institutional, financial and regulatory barriers to research training during residency. The primary aim was to incorporate a research track within a 4-year psychiatry residency program for physicians. A secondary goal was to extend recruitment into earlier phases of medical training by offering summer research fellowships to medical and undergraduate students.

RESULTS—This paper describes the program including core mechanisms of training, recruitment, and outcomes to date.

CONCLUSIONS—The program provides a model to effectively integrate research training during residency without increasing the number of years of residency training. The training components described herein should be exportable to other psychiatry residency training programs and potentially other specialties of medicine.

Keywords

residents; research training; academic career; physician-scientist; investigator

Introduction

The participation of physician-scientists in the biomedical research enterprise helps bridge the gap between basic science and clinical practice to address the healthcare needs of the public. In recent years, however, the number of physicians engaged in research careers has declined by over half, as have the number of research psychiatrists and research fellowships for psychiatrists (1-5). Physicians with in-depth experience and formal training in research design, development, implementation, statistical analysis, and interpretation of scientific information are becoming a “rare species” (6). Indeed, a recent study investigating the success rates of MDs, as compared to PhDs, in obtaining federal funding showed that physicians have lower rates of success with first-time R01 applications and are less likely to

Corresponding Author: Sudie E. Back Ph.D., Department of Psychiatry and Behavioral Sciences, Clinical Neuroscience Division, Medical University of South Carolina, 67 President St., P.O. Box 250861, Charleston, SC 29425. Telephone (843)792-5215, Fax (843)792-0528. backs@musc.edu.

obtain subsequent R01 grant funding (7). Combined MD/PhD programs routinely graduate MDs with formal research training. However, the vast majority of medical school graduates do not have PhDs and the number of these physicians pursuing research careers is on the decline.

Barriers to Research Training for Physicians

A number of factors are likely associated with the decline in research training during or in close proximity to psychiatry residency. Although some research training options for premedical and medical students exist, they are often too brief to allow the trainee to make informed career decisions (8). Aside from well-established combined MD/PhD programs, research training experiences that are offered during residency are typically brief and fragmented across years of training (5). Another barrier is limits on faculty time and funding for mentoring (4,9). The presence of at least one mentor during training is associated with the development of successful investigators and is especially important in acquiring skills in grant writing, project implementation, and manuscript preparation (10-12). This has become a critical issue as academic medical centers are under unprecedented financial pressures, and faculty are directed to spend increasing amounts of time in revenue-generating activities. While the NIH mentored “K-series” mechanisms have been important in increasing the number of physicians choosing research careers, they do not provide direct financial support for mentoring or infrastructure support, and they have a relatively low indirect cost recovery rate of 8%. Finally, since research training traditionally extends the period and cost of medical education, students with excessive debt favor higher paying clinical salaries, especially residents in psychiatry since it is among the lowest paid medical specialty (3,5,9,13-15).

Research Training During Residency

In response to the shortage of physician-scientists, the Institute of Medicine (IOM) convened a panel to study research training in the careers of psychiatrists. The panel noted that residency-based research training might have the benefit of solidifying research career interests for greater numbers of psychiatrists. One of the recommendations was that “departments of psychiatry should organize optional research experiences and mandatory research didactics in residency as early steps in research career development” (3).

Based on the IOM's recommendation, the Medical University of South Carolina (MUSC) launched an NIH-funded research track (R25 mechanism) in 2006 to address the institutional, financial and regulatory barriers to residency research training (<http://www.musc.edu/psychiatry/research/cns/DART/dart.htm>). The primary aim was to incorporate a research track within a 4-year psychiatry residency program for physicians committed to pursuing clinical research careers. The research track can be integrated within any of the three main psychiatry residency programs offered at MUSC (i.e., General Psychiatry, Combined General Psychiatry and Internal Medicine, Combined General Psychiatry and General Neurology). A secondary goal was to extend recruitment into earlier phases of medical training by offering summer research fellowships to medical students and undergraduate trainees.

The research track at MUSC, known as the Drug Abuse Research Training (DART) program, focuses on addictions research; however, residents with associated research interests (e.g., depression, bipolar disorder) also participate. The DART program is unique in that it establishes the infrastructure and organizational support necessary to train physician-scientists, and it addresses deficiencies in the mentoring of residents by providing compensation to research faculty mentors. In 2009, the DART program received the American College of Psychiatrists Award for Creativity in Psychiatric Education for its use

of innovative strategies to overcome existing barriers to physician research training, namely: (1) access to research mentors; (2) support for research training time during residency; and (3) financial support, such as funding for pilot projects, travel to present research at conferences, and potential eligibility to apply for the NIH Loan Repayment Program (LRP). This paper describes the DART program including mechanisms of training, recruitment, and outcomes to date. The training components described herein should be exportable to other psychiatry residency training programs, and potentially other specialties of medicine.

General Program Description

DART is a 2-year research track, encompassing the final two years of psychiatry residency training (PGY3 and PGY4). Table 1 illustrates how the program is incorporated into the parent residency program. During PGY1, potential DART residents are encouraged to meet with possible research mentors and consider areas of research that interest them. During PGY2, interested residents formally apply to the DART program. Applications are submitted in the early Spring of PGY2 and include a curriculum vitae; a 1-2 page statement of research interests; and two letters of reference, one of which is from the applicant's research mentor who will be supervising their work during the DART program. Approximately 3-4 new residents are accepted into the program each year. Selection is based on a number of criteria, including the candidate's research potential, their research mentor, and the quality of the statement of research. While research experience and publication history is taken into consideration when reviewing candidates, prior research experience is not essential. This is in contrast to other physician-scientist training programs (14) that accept only residents with substantial prior research experience (e.g., MD/PhD degrees). Although we would not preclude dual degree MD/PhD students from participating, none have applied to the program thus far. One DART alumnus has an MD and a PhD, but he entered medical school after completion of a PhD and was not enrolled in a combined MD/PhD program.

Selected residents spend approximately 50% time during PGY3 and PGY4 in a well-coordinated curriculum that includes core research training activities described below that are designed to facilitate the attainment of the research skills listed in Table 2. These activities have been consistently evaluated by trainees as beneficial and have been ranked by trainees with regard to importance in the following order:

Core Research Training Activities

1. Individual, regular meetings with the resident's faculty research mentor.
2. Bi-annual evaluations with the research mentor and DART administrators to review the resident's training progress and discuss both short and long-term research career goals.
3. Residents are provided a modest amount of funds to conduct a pilot project. They work closely with their mentor to design a study, prepare and submit an IRB application, collect data, and participate in the data analyses, interpretation and dissemination process. Data from pilot projects may be used as pilot data for grant applications.
4. A formal, didactic seminar series that addresses the skills necessary for a successful research career, such as, methodological skills (e.g., study design, data collection, and statistical techniques), dissemination of research findings (e.g., manuscript preparation, oral presentations, research posters), responsible conduct of research (e.g., the Institutional Review Board, human subjects protection, adverse event reporting, conflict of interest) and grant preparation (e.g., preparing a K-Award,

grant budgets, funding sources and mechanisms). Approximately 40 seminars are given per year.

5. Attendance at professional conferences.
6. Formal coursework (e.g., epidemiology, multiple regression, neuroimaging).

Each trainee is required to attend at least 80% of didactic seminars, submit at least one manuscript and one conference abstract, complete two courses (one online and one at MUSC) in the responsible conduct of research, engage in a pilot project, meet with their research mentor on a regular basis, and attend a grant writing workshop. In addition to these core requirements, an individualized training plan is generated for each resident. At the beginning of the program (PGY3), an initial assessment of current research knowledge and skills is conducted and is used to guide the development of the resident's training plan (see Needs Assessment and Annual Goals forms at the end of the manuscript). This assessment helps to ensure that deficiencies in training that would serve as an impediment to a successful independent research career are targeted. These forms are then reviewed during the bi-annual evaluations.

Recruitment of Residents

Three main forms of “marketing” were created to inform potential applicants about the DART program, including a program website (<http://www.musc.edu/psychiatry/research/cns/DART/dart.htm>), brochure and newsletter. The website, in particular, includes information about the program and its requirements, how to apply, seminar series topics and dates, trainees and research mentor profiles, and trainee research dissemination activities. DART recruitment essentially begins during the residency application process (fourth year of medical school), although undergraduates and first year medical students also have exposure to DART through the Summer Research Fellowship (described below). DART representatives participate in the psychiatry residency selection process to insure that adequate information about the research track is available to the applicants and selection committee. During the PGY1 and PGY2 years, the DART program is advertised at lectures and meetings, and the program newsletter and brochure are distributed to PGY1 and PGY2 residents.

Summer Research Fellowship

In order to target students earlier in their career development, a summer research initiative was created. The Summer Research Fellowship provides the opportunity for undergraduate and medical students to spend 12 weeks working closely with a research mentor at MUSC. During this time, students assist with research projects and research-related tasks, such as, data collection and entry and literature searches. At the end of the summer, students give a formal presentation to their peers and program mentors describing their research experiences. Students receive ~\$3,000 for their efforts. Since its inception in 2008, the Summer Research Fellowship has involved 9 students, including medical students from MUSC as well as undergraduate students from other universities. Examples of summer research projects include the study of neuroimaging in nicotine dependence, stress reactivity and prescription opioids, women's post partum mental health, and cocaine-induced neuroplasticity. The complete list can be found on the DART program website.

Trainee Accomplishments

Since its inception in 2006, 14 residents have participated in the DART program. The following activities are assessed annually: (a) the number and quality of manuscripts submitted and/or published, (b) the number and quality of abstracts submitted and/or

accepted for presentation at research conferences, and (c) attainment of research or career development awards. The 14 residents who have participated in the program thus far have generated 36 abstracts submitted to local and national meetings, 28 manuscripts submitted for publication, and 13 Institutional Review Board applications. In addition they have received numerous research-related and teaching awards (e.g., Career Development Institute Awards, Travel Awards to national conferences, the APIRE/Janssen Resident Research Award). Of the 8 residents who have graduated from the program, 4 have chosen to complete a fellowship in Addiction Psychiatry, 3 have chosen Child Psychiatry Residencies, and 1 accepted a junior faculty research position (Assistant Professor). Alumni of the DART program will be followed for 10 years in order to assess research-related activities and productivity (e.g., manuscripts, abstracts, funding proposals submitted and obtained, percent time spent conducting research, positions secured).

Funding Considerations

NIH funds were used to cover the costs of, for example, program administration, pilot projects and research assistance (i.e., statistical consultation) for trainees. In addition, each primary mentor received 5% salary support. We consider this to be important to the success of the program because it allowed us have clear expectations for the time, effort and role of the mentors. Because good mentorship is such a critical element in research training, this level of accountability of the mentors helped to insure the success of the trainees. The NIH funding provided the impetus to begin the program. The salary and administrative support was particularly helpful during the early stages of program development, which can be very time consuming. However, if the program continues beyond the period of NIH funding, the department will need to provide support for ongoing activities. In the case where a department is unable to obtain NIH funds for program development, an investment would need to be made to initiate a research track within the residency. In order to keep costs down, mentors could be asked to provide the necessary resources for trainee pilot projects. Nevertheless, the financial status of many psychiatry departments in the current health care financing climate may be an impediment to initiating such a program.

Conclusions and Future Directions

The DART program provides a model to effectively integrate research training during residency without increasing the number of years of residency training. The program recruits and mentors physicians to help advance them toward becoming independent investigators, provides a consistent curriculum of research training that begins early on during residency, and provides summer research training for undergraduate and medical school students so they may be exposed to research early in their career trajectories.

Although the DART program helps overcome many obstacles to resident research, several important challenges exist. First, there is an insufficient “bridge” between completing residency and obtaining a faculty appointment. Most of the residents in the DART program are not ready to submit a Career Development Award during the PGY4 year. At MUSC, we have several fellowships that residents may enter into immediately following residency, which also gives them more time to prepare the grant application, but many universities are unable to offer fellowships. Furthermore, if junior researchers join the faculty without protected research time, the success of their long-term research career goals may be jeopardized. Secondly, financial challenges remain an obstacle. The Loan Repayment Program has been extremely beneficial in helping relieve resident debt load, however it has become increasingly more competitive to obtain. In addition, the financial considerations mentioned earlier may limit the exportability of this program.

Finally, more women and under-represented minorities (URM) need to be integrated into residency research training programs (16,17). Thus far, 38.5% of DART residents have been women and 7.1% URM . These numbers are likely a direct reflection of the make-up of MUSC's residency training program (41% women, 9% URM). The women in the DART program have done as well as their male counterparts in all arenas (e.g., research productivity, grant submissions, obtaining post-DART fellowship and faculty positions). The DART program's success at attracting women physicians to clinical research may be attributed to the mentoring process, in which the quality of the mentoring relationship is emphasized and mentors are compensated for their efforts. Sakamoto and Dipple (18) comment that one of the most important factors contributing to their success as women physician-scientists is supportive mentorship. Outreach efforts to URM and women coupled with careful attention to the mentoring process will be important in increasing diversity in the physician-scientist community.

In conclusion, the DART program has been successful in providing a clinical research experience for psychiatry residents, medical students and undergraduates. Most of the DART graduates have embarked on a career in academic medicine in which they are continuing their research activities. If financial barriers can be overcome, programs like this one may be of value in providing a much needed increase in the number of physicians involved in clinical research.

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NEEDS ASSESSMENT

DART Resident's Name:		
Year in Residency Program:		
Primary Mentor's Name:		
INSTRUCTIONS: Please rank the following items from 1 to 5 for your level of skill (1 = few skills in this area to 5 = strong skills in this area) and importance to your career development (1 = of little importance to 5 = of great importance).		
<i>Knowledge and skill areas:</i>	Level of Skill	Importance to Career Development
Research Design and Methods		
Critically evaluate research literature in your area of interest	_____	_____
Formulate hypotheses and operationally define variables	_____	_____
Knowledge of sampling techniques, sample size issues, and power	_____	_____
Understand validity and reliability	_____	_____
Knowledge of different types of research designs	_____	_____
Knowledge of different assessment methods	_____	_____
Data Collection, Management & Analysis		
Construct a plan for data collection	_____	_____
Knowledge of how to create and maintain data files	_____	_____
Understand commonly used statistical tests	_____	_____
Knowledge of available statistical packages	_____	_____
Interpret p-values and statistical output	_____	_____
Disseminating Research Findings		
Attend a research conference in your area of interest	_____	_____
Submit an abstract for presentation at a research conference	_____	_____
Present a poster or oral presentation at a research conference	_____	_____
Prepare, submit, and revise a manuscript for publication	_____	_____
Integrate findings into the existing literature	_____	_____
Public speaking/oral presentation skills	_____	_____
Human Subjects Protection and Research Ethics		
Principles of good research practice, responsible conduct of research	_____	_____
Ethical considerations in conducting drug abuse clinical research	_____	_____
Elements of an informed consent document	_____	_____
Research with vulnerable populations	_____	_____

<i>CONTINUED</i>	Level of Skill	Importance to Career
Research Administration		
Knowledge of how to secure and maintain IRB approval	_____	_____
Knowledge of how to prepare and manage research budgets	_____	_____
Knowledge of Phase I-IV clinical trials	_____	_____
Supervise research staff, liaison with clinical personnel	_____	_____
Grant Writing		
Knowledge of research funding sources	_____	_____
Knowledge of grant forms, cycles and review process	_____	_____
Grant writing skills	_____	_____
Computer Skills		
Searches, software and file sharing	_____	_____
Other		
Please list other skill(s): _____	_____	_____
_____	_____	_____

Resident Signature _____	Date _____
Primary Mentor Signature _____	Date _____
DART Program Member Signature _____	Date _____

ANNUAL RESEARCH GOALS

DART Resident's Name: _____
Year in Residency Program: _____
Primary Mentor's Name: _____

1. *List the Research Training Components you will complete this year* (e.g., Clinical Translational Research Center Rotation; Grant Workshop; Formal Coursework)

2. *List your Annual Research Goals* (e.g., submit at least one manuscript for publication, gain experience with data entry and statistical analysis; present at a research conference):

3. *List the Research Skills you will target this year* – See Needs Assessment Template. (e.g., manuscript writing; oral presentation skills; research design and methodology, human subjects protection, data entry and analysis):

4. *List the specific Research Projects you will be involved in this year with your mentor:*

Resident Signature _____	Date _____
Primary Mentor Signature _____	Date _____
DART Program Member Signature _____	Date _____

*Note. Greater space is allowed for residents to list goals and research projects on items 1-4 above. Space is reduced here because of page limitations.

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PGY 1	Neuro 1 mo	Internal Medicine 4 mo			Adult Inpatient Psychiatry 4 mo	Emerg Psy 2 mo	Child 1 mo
PGY 2	Neuro 1 mo	C-L Psy 2 mo	Emerg Psy 1 mo	Geriatric 1 mo	Adult Inpatient Psychiatry 4 mo	Elective Rotations 3 mo	
PGY 3	DART Program Mentored Research and Didactics						
	Outpatient Adult and Child Psychiatry						
PGY 4	DART Program Mentored Research and Didactics						
	Outpatient Adult and Child Psychiatry						

Note. Neuro = Neurology, Emerg Psy = Emergency Psychiatry, C-L Psy = Consult Liason

Figure 1.
Timeline Illustrating How DART and the Parent Residency Program are Integrated

Table 1

Research Track Domains and Corresponding Learning Objectives

Domain	Learning Objectives
Research Design and Methods	Critically evaluate research literature Formulate hypotheses and variables Design, assessments, operational definitions Sampling techniques, sample size, power Rating scales, questionnaire/survey design
Human Subjects Protection and Research Ethics	Principles of Good Research Practice Ethical considerations in the conduct of clinical research
Data Collection, Management, and Analysis	Construct plan for data collection & entry Construct data file management plan Understand statistical significance Commonly used statistical tests & software Interpret statistical output
Disseminating Research Findings	Display outcomes data Prepare/submit conference abstracts Prepare/submit journal manuscripts Integrate findings into existing literature Offer caution in interpreting results Oral and poster presentations
Research Administration	Secure and maintain IRB approval Develop and revise study timelines Prepare and manage budgets Supervise research staff Liaison with clinical personnel
Grant Writing	Learn about funding sources, mechanisms, forms, cycles, and review procedures Grantsmanship
Professional Development	Career phases and academic expectations Collaborators, consultants, networking Time management
Computer Skills	Literature searches, software, file sharing