

Engaging College-Level Baccalaureate-MD Students in Clinical Research

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ABSTRACT

College students in baccalaureate-MD (BA/MD) programs are well situated to get involved with clinical research as a component of their scholarly enrichment. The authors review the educational and professional development benefits of BA/MD college research in the United States (US), the lack of evidence-based strategies to guide program innovation, lessons from non-US medical school research enrichment efforts, and teaching models that can help boost BA/MD research engagement at the college level. Collaboration on part of program directors, faculty and students can help strengthen the quality and accessibility of research opportunities with a focus on longitudinal skills building and professional mentorship.

KEYWORDS: medical education, baccalaureate-MD, research

INTRODUCTION

Combined medical (BA/MD) programs in the United States (US) offer students the opportunity to gain their baccalaureate and medical degrees in six, seven, or eight years.¹ For many BA/MD programs, the motivation is to allow students to pursue a broad-based liberal education, free from the academic stressors of applying and gaining acceptance to medical school.^{1,2} Especially in eight-year (non-accelerated) programs, which comprise 27 out of 49 (55%) of BA/MD programs,² early acceptance into medical school can free up time for college students to explore new experiences in and outside of the classroom that will help them become well-rounded future physicians. Engaging in research is an excellent case in point. However, there is a dearth of literature on the research experience of college students in US BA/MD programs.^{1,2} Herein, we highlight the educational opportunities to engage BA/MD students in scholarly research and potential strategies to spearhead these efforts during their baccalaureate years. We focus on programs in the US as most medical training outside the US begins at the undergraduate level.³

WHY RESEARCH EXPERIENCE MATTERS

Early research experience can confer essential skills that aid students as future clinicians (**Table 1**) and researchers.⁴ Many of these skills are in line with competency-based curriculum goals outlined by medical schools, such as the Alpert Medical School of Brown University, which requires graduates to develop knowledge, skills and personal and professional values surrounding The Nine Abilities.⁵ Also, students can work longitudinally with academic faculty during college and medical school. Clinician-research mentors can provide insight on the application of research in different fields and provide students with shadowing opportunities in the clinic, hospital and operating room. In addition, early exposure to clinical medicine can help inform the students' decision-making regarding medical specialty and future research endeavors.

Table 1. Skills that college BA/MD students can gain from research involvement

Category	Skill/Benefit
Teamwork	<ul style="list-style-type: none"> - Communication^{5,6} - Collaborating on multidisciplinary teams⁷ - Project management⁸ - Leadership
Interpreting and conducting scientific research	<ul style="list-style-type: none"> - Problem solving skills⁹ - Asking the right questions and stimulating intellectual curiosity - Connecting basic science to the practice of medicine and clinical decision making⁵ - Contributing to study design - Critically evaluating new literature⁴ - Disseminating research findings through presentations at professional meetings¹ - Contributions to the peer-reviewed literature
Professional development	<ul style="list-style-type: none"> - Explore a specialty of interest^{5,6} - Gain mentorship - Improve understanding of career opportunities in academic medicine¹¹

NEED FOR EVIDENCE-BASED APPROACHES

In 2011, 31 (79%) of 39 surveyed BA/MD programs reported offering extracurricular activities that "entailed community service or some type of clinical experience but could also take other forms such as research or field work." Moreover, 42 (53%) of BA/MD programs aimed to "decrease competitive

Table 2. BA/MD Programs that Require College Participation in Research

Program	Program Length (years)	Duration of research
Florida A&M University Medical Scholars Program	8	One summer
Augusta University Professional Scholars Program	7	One summer
University of South Florida Seven Year Medical Program	7	Two semesters
University of Pittsburgh Guaranteed Admissions Program	8	No specific duration

pressures, provide strong support services, integrate the liberal arts with the biomedical sciences, or include clinical or research experience⁷² during the baccalaureate years. Several BA/MD programs require college research participation for medical school (Table 2). However, to our knowledge, there is no published research on the implementation and effectiveness of research enrichment strategies in BA/MD programs and the few published reports on BA/MD programs do not include an assessment of student research.^{1,2}

While there are no studies focused specifically on BA/MD college student research, scholarly research programs for medical students at Duke and Stanford demonstrated that research enrichment can cultivate appreciation for research, teach research study methodologies, stimulate scholarly output, and influence career choices related to academic medicine.¹¹ Furthermore, these two programs provide several lessons that can inform the development of research programs for college BA/MD students: (1) academic faculty should be prepared to provide time to work with students prior, during, and after the completion of their research projects; (2) administrators should ensure students have the resources and support to maximize their potential for success, and (3) research programs should aim to accommodate the interests of a diverse student body.¹¹

LESSONS LEARNED FROM RESEARCH PROGRAMS AT NON-US MEDICAL SCHOOLS WHERE TRAINING BEGINS AT THE UNDERGRADUATE LEVEL

Studies of undergraduate research programs at non-US medical schools offer several lessons regarding the stewardship of research enrichment in post-secondary school education:

- The Medical Research Volunteer Program (MRVP) at the American University of Beirut emphasized four major pillars for success: the students, the faculty members, the MRVP committee, and an online portal which helps generate suggestions of potential student-project matches based on student, faculty, and project characteristics.¹²

- Belgium researchers found that training in literature analysis skills and statistics can help improve the link between medical education and research at the undergraduate level.¹³
- An analysis of 475 undergraduate student research projects in the United Kingdom identified information gathering (418, 88%), data processing (304, 64%), critical analysis (147, 31%), and research methods (87, 18%) as research skill developmental opportunities offered by the projects.¹⁴
- Dutch researchers found that undergraduate research as a didactic format is more effective at conferring writing and information retrieval skills relative to a traditional lecture-based skills course.¹⁵

STRATEGIES AND TEACHING MODELS TO BOOST THE AVAILABILITY, QUALITY, AND ACCESSIBILITY OF RESEARCH OPPORTUNITIES

The success of BA/MD research enrichment depends on the students' ability to find research opportunities with dedicated faculty, build skills longitudinally, and contextualize their research experiences with their future training as clinicians. Key BA/MD program stakeholders can utilize several strategies to help facilitate these goals (Table 3).

Furthermore, we highlight three innovative teaching models that can be used by BA/MD programs to boost research engagement at the college level:

- **Group-Effort Applied Research (GEAR):** Some programs may choose to offer GEAR projects, by which students gain research training in a class format and work together in teams on research projects.¹⁷ This approach helps address inefficiencies related to the one student-one mentor model, namely limited availability of research opportunities to a few students, variability in project outcomes, and sparse peer support.¹⁷ Also, GEAR provides standardized learning experiences for all students involved.
- **Structured research experiences:** The BA/MD program directors may also sponsor faculty-student projects that emphasize structured undergraduate research as a teaching model.¹⁸ Several BA/MD programs have structured research opportunities in place (Table 4). Faculty mentors and students work together to design a research plan and set of assignments that will guide the student in achieving their goals related to skills development and content mastery. Also, students receive and provide mentorship through scheduled meetings with the faculty mentor, research staff, medical students, and college students with different levels of research experience. In addition to research training, this approach confers project management and teaching experience.

Table 3. Developing Student Enrichment Strategies

Strategy	Action Items	Examples
Make it easier for students to find faculty mentors	- Boost the accessibility of research faculty for students	- Host a networking event for students to meet faculty that are interested in mentoring students - Make faculty contact information readily available - Keep an updated list of new research opportunities - Arrange training sessions for students to learn how to email and interview for research opportunities
Improve the quality of student involvement in research activities	- Encourage students and their faculty mentors to synthesize a list of skills and techniques that the students should gain throughout their research involvement	- Targeted skills list example: "Asking questions, building and evaluating models, proposing hypotheses, designing studies, selecting methods, using the tools of science, gathering and analyzing data, identifying meaningful variation, navigating the messiness of real-world data, developing and critiquing interpretations and arguments, and communicating findings" ¹⁶
	- Educate students about different types of research outcomes	- Encourage students to publish, present their work at conferences, learn scientific methodology, and understand medical publications. ¹¹ - Provide funding for summer research and travel grants for conference presentations - Host poster sessions that showcase student and faculty mentor contributions to research projects
	- Emphasize the importance of working in multidisciplinary teams with trainees	- Encourage student involvement in group meetings to provide them opportunities to engage in scientific discussion and present their results - Encourage teamwork and mentorship among trainees (college, medical, graduate students) and faculty across different levels of seniority
Emphasize longitudinal research experiences	- Provide support for faculty and students to design projects that take place during the summer and academic year	- Provide opportunities for students to gain academic credit or funding for year-long involvement in research
	- Emphasize the opportunity for faculty to work with students throughout their college and medical school years	- Host information sessions with medical faculty and boost advocacy for college BA/MD research mentorship

Table 4. BA/MD Programs with Structured Research Opportunities

Name of BA/MD Program	Name of Research Opportunity
Brown University, Program in Liberal Medical Education	Summer Research Assistantship in Social/Behavioral Sciences, Clinical Medicine, or Biomedical Sciences; Summer Research Assistantship in Emergency Medicine; Undergraduate Research and Teaching Award (open to all Brown University students)
Rensselaer Polytechnic Institute-Albany Medical College	Physician-Scientist Program (longitudinal research experience)
Northwestern University, Honors Program in Medical Education	Summer Research Program

- **Clinician-researcher skills-based workshops:** Some BA/MD programs are not affiliated with a major research institution,¹⁹ which may make it difficult to access research opportunities. Program directors can arrange for visiting clinician-researchers to host research methodology workshops focused on biostatistics, epidemiology, and scientific writing in the context of live research projects. Short of conducting actual research, these workshops can provide students with exposure to research principles that can improve their likelihood of landing research positions during their summer college months and medical school.

The BA/MD program directors also can leverage the unique strengths of their research faculty and alumni networks as well as the proximity of academic hospitals to enhance the research enrichment of BA/MD students. For example, this year, college students in the Program in Liberal Medical Education (PLME) at Brown University who receive a Summer Research Assistantship²⁰ will be required to present either a poster or an oral report at a fall research symposium. At the symposium, PLME deans and faculty will review strategies for students to apply for research funding and find faculty mentors. The PLME could also organize large scale networking events and coffee chats among college students

and faculty to facilitate the dissemination of research project opportunities offered at affiliated teaching hospitals or offer student travel grants to present research at scholarly conferences during the academic year.²⁰

LOOKING AHEAD

Specific teaching models aside, research enrichment programs should help students gain a greater appreciation of the research process, ways to connect basic science to the bedside, and the excitement of contributing to the research community.¹⁷

More evidence-based research and best practice guidelines are needed to identify effective ways to engage these unique students in research. With institutional support and engagement among program directors, faculty and students, BA/MD programs can take additional steps to target research experience as a complement to a broad-based liberal education. Research engagement is a special opportunity to help BA/MD students develop critical thinking, communication, and teamwork skills that are paramount to the practice of evidence-based medicine,^{4,7,9-10} while also strengthening their professional development and the physician-scientist pipeline.

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