Purpose: There are ongoing concerns about the size and composition of the biomedical-research workforce, in general,[1,2] and of the physician-scientist workforce, in particular.[3] Physician-scientists, including both MD-PhDs and other MDs, make important research contributions, especially through patient-oriented clinical research. Although the number of U.S. physicians has increased substantially since 1980, the number of physicians whose primary activity is research has declined,[3,4] and compared to the diversity of U.S. medical-school graduates,[5] there is a lack of gender and racial/ethnic diversity among physicians in the National Institutes of Health (NIH)-funded research workforce.[3] We therefore sought to determine the prevalence of federal research award receipt among U.S. LCME-accredited medical-school graduates and identify predictors of award receipt.

Approach/Methods: Individualized de-identified data for graduates in 1998-2004 were obtained from the Association of American Medical Colleges and the NIH Information for Management, Planning, Analysis, and Coordination (IMPAC) II grants database through August 2014 (≥10 years of follow-up after graduation). In multivariable logistic regression models, we examined 12 potential predictors of each of F32 post-doctoral fellowship, mentored-K, and R01 awards: gender, race/ethnicity, graduation year, formal research experiences in high school, college, and medical school, medical-school research-paper authorship, research-intensive medical-school attendance, career intention at graduation, degree program, debt, and specialty. We report select findings significant at P<.05 (adjusted odds ratios [95% confidence intervals]).

Results/Outcomes: Among 97,866 graduates in the sample, there were 407 F32, 1,388 mentored-K, and 420 R01 awardees. Black, Hispanic, and American Indian/Alaska Native graduates were disproportionately underrepresented among F32, mentored-K, and R01 awardees in our sample; women were underrepresented among F32 and R01 awardees. Black graduates were less likely (0.50 [0.27-0.92]), and graduates with college (1.44 [1.16-1.78]) and medical-school (1.56 [1.15-2.12]) research experiences were more likely to be F32 awardees. Black (0.52 [0.38-0.70]) and Hispanic (0.69 [0.52-0.91]) graduates were less likely, and graduates with high school (1.44 [1.25-1.66]), college (1.48 [1.31-1.66]), and medical school (1.52 [1.29-1.80]) research experiences, and with medical-school authorship (1.59 [1.38-1.83]) were more likely to be K awardees. Women (0.56 [0.45-0.69]), Black (0.41 [0.22-0.78]), and Hispanic (0.57 [0.33-0.98]) graduates were less likely, and graduates with college research experience (1.34 [1.08-1.65]) and medical-school authorship (2.05 [1.57-2.68]) were more likely to be R01 awardees. Graduates who had research-related (vs. full-time clinical practice) career intentions at graduation were more likely to be F32 (4.69 [3.41-6.45]), mentored-K (7.30 [6.00-8.90] and R01 (7.23 [5.12-10.21]) awardees.

Discussion: In models that included numerous predictors of award receipt, various research-related experiences at multiple points along the educational continuum were positively associated with federal F32, mentored-K, and R01 grant awards, but Black and Hispanic graduates were each less likely to have received mentored-K and R01 awards.

Significance: Increasing formal research opportunities for students in high school, college, and medical school and encouraging/allowing for authorship opportunities should serve to increase medical graduates' participation in the federally funded research workforce. Further research is warranted to determine if the racial/ethnic and gender disparities in award receipt that we observed reflect differences in research-grant application rates, in applicant success rates, or both.

References:
2. National Institutes of Health Working Group on Diversity in the Biomedical Research Workforce (WGDBRW), The Advisory Committee to the Director (ACD). Draft report of the Advisory Committee to the Director Working Group on Diversity in the Biomedical Research Workforce. June 13, 2012. Available at:

Level of Audience: Early-career
Focus of Presentation: Continuum
PRESENTER: Donna Jeffe
AUTHORS/INSTITUTIONS: D.B. Jeffe, Medicine, Washington University School of Medicine, St. Louis, Missouri, UNITED STATES|D.A. Andriole, Surgery, Washington University School of Medicine, Saint Louis, Missouri, UNITED STATES|
Purpose: Recruitment and retention of a more diverse biomedical-research workforce, in general,[1,2] and of a more diverse physician-scientist academic-medicine workforce, in particular,[3] are ongoing national concerns. Despite efforts to address these concerns, a lack of diversity persists.[3] In a national-cohort study examining factors associated with academic-medicine workforce diversity, we examined the career trajectories (promotion and attrition) of U.S. medical-school graduates appointed to full-time faculty positions.

Approach/Methods: We analyzed de-identified data from the Association of American Medical Colleges and National Institutes of Health (NIH) IMPAC II grants database (for mentored-K and research project grant [RPG] awards, including R01 and other RPG awards) for 1997-2004 graduates initially appointed to full-time, instructor or assistant professor faculty positions in 2000-2012. Using multivariable proportional subdistribution hazards models with promotion and attrition as two competing events,[4] we measured adjusted subdistribution hazards ratios (aSHR) of promotion and attrition in association with several variables of interest. We report selected aSHRs significant at P < .05.

Results/Outcomes: Of 29,795 eligible faculty appointees (24.8% of 119,906 graduates), we examined data for 28,306 first-time appointees: 11,087 (39.2%) instructors and 17,219 (60.8%) assistant professors. Followed through December 2013, 7,356 (26.0%) were promoted; 7,769 (27.4%) left academic medicine without promotion; and 13,181 (46.6%) remained in academic medicine at their initial ranks. Higher aSHRs of promotion were observed for MD-PhD-program graduates (1.17; vs. all other MD graduates), research-intensive medical-school graduates (1.10; vs. non-research-intensive medical-school graduates), mentored-K (1.26) and RPG (1.69) awardees (each vs. non-awardees), and instructors (7.71; vs. assistant professors). Lower aSHRs of promotion were observed for women (0.89; vs. men), underrepresented minority (URM, including Black, Hispanic and Native American/Alaska Native), and Asian/Pacific Islander (PI) appointees (URM: 0.79 and Asian/PI: 0.93; each vs. white). Higher aSHRs of attrition were observed for URM (1.21) and Asian/PI (1.12) appointees, faculty who reported $1-$99,999 or ≥$100,000 debt at graduation (1.10 and 1.15, respectively; each vs. no debt), instructors (1.32), and appointees who reported non-faculty career intentions at graduation (1.49; vs. full-time faculty career intentions). Lower aSHRs of attrition were observed for MD-PhD-program graduates (0.83), and mentored-K (0.26) and RPG (0.23) awardees.

Discussion: Gender and racial/ethnic disparities were evident in the academic-medicine career trajectories of U.S. medical-school graduates in our national cohort. Instructors comprised a uniquely dynamic group, with higher aSHRs (vs. assistant professors) for both promotion and attrition. Higher aSHRs for promotion and lower aSHRs for attrition were observed for all research-related variables; higher aSHRs for attrition were observed for both debt and non-faculty career intentions at graduation.

Significance: Continued efforts are warranted to support women, URM, and Asian/PI faculty appointees’ career development after appointment to increase workforce diversity. The salience of research experiences in academicians’ career trajectories is worth reiterating. To our knowledge, this is the first study to examine career intention and debt at graduation in association with faculty career trajectories. Our findings underscore the importance of medical-school programs that inform diverse groups of students about and encourage them to pursue academic-medicine careers.[5] Debt-reduction interventions for indebted faculty appointees also could reduce academic-medicine attrition.


**Level of Audience:** Early-career

**Focus of Presentation:** Continuum

**PRESENTER:** Donna Jeffe

**AUTHORS/INSTITUTIONS:** D.B. Jeffe, Medicine, Washington University School of Medicine, St. Louis, Missouri, UNITED STATES| Y. Yan, D.A. Andriole, Surgery, Washington University School of Medicine, Saint Louis, Missouri, UNITED STATES|
Purpose: MD-PhD programs are highly competitive and lengthy physician-scientist training programs, involving transition phases: from MD-to-PhD and from PhD-to-MD training. Little research has explored specific transition experiences.

Approach/Methods: Following IRB approval, we used purposeful and snowball sampling recruitment techniques and conducted one-on-one, 60-minute, semi-structured telephone interviews from 2011-2013 with MD-PhD students/graduates. All participants had at least three years of training and had undergone at least one transition. We asked open-ended questions about a broad range of experiences during training. Interviews were audio-recorded and transcribed verbatim for inductive thematic analysis. Following literature review, in-depth coding and data categorization, we developed themes, triangulating findings with the sparse literature to improve trustworthiness of our interpretation.

Results/Outcomes: Transition experiences emerged spontaneously as a theme for 45 (61% of 74 MD-PhD participants) from 20 U.S. schools. These transitions were discussed as a lone journey for MD-PhD students, who were few in number. Overall, three broad transition-related challenges emerged:

Challenges relating to program structure included lack of integration between the MD and PhD curricula and competition with peers in MD-only or PhD-only programs. The MD-to-PhD transition was disjointed, involving shifting from didactic teaching and memorization to determining a research focus, developing critical-thinking skills, and lacking a standard curriculum. Unlike MD students, PhD students did not work closely with peers. PhD-to-MD transition entailed at least a 4-year gap in MD training, which led to struggles to regain preclinical knowledge to apply during clerkships and complete with their MD-program peers. They also needed to learn doctor-patient communication skills and develop new relationships with MD mentors.

The culture and socialization of MD-PhD students presented other challenges. MD-PhD students were not viewed as "real" MDs or PhDs by their respective program faculty, peers, or administration. In the MD-to-PhD transition, students found a lack of peer support/interaction from PhD students, who had already formed "cliques." The Phd-to-MD transition was considered more difficult, involving a culture shock and lack of intellectual exchanges. After developing peer/colleague relationships with PhD faculty, clinical medicine seemed hierarchical; students needed permission from professors for everything and were verbally abused, yelled at, and mistreated. Culture differences made it harder to transition back after becoming an established researcher. Age differences also limited interactions with MD-only peers, who were much younger.

Lack of mentors with MD-PhD degrees also was a challenge. Participants wanted MD-PhD mentors who had experienced similar transition experiences to guide them during research transitions and back into clinical training. While some PhD mentors focused on topics not relevant to medicine, MD mentors could not help connect MD-PhD students’ clinical training with their research. Overall, there was disconnect between the two training phases in terms of coursework, research topics, and mentoring styles.

Discussion: Lack of program integration caused feelings of alienation and lack of confidence. Students experienced unexpected cultural differences, including needing to be autonomous during research and then relinquishing that independence during clerkships.

Significance: Participants drew attention to specific areas where better supports are needed for MD-PhD students, e.g., through re-immersion programs, leadership-training workshops, and patient-oriented research programs.


2. Goldberg C, Insel PA. Preparing MD-PhD students for clinical rotations: Navigating the interface between PhD and MD training. Acad Med 2013; 88(6):745-


**Level of Audience:** Early-career  
**Focus of Presentation:** GME  
**PRESENTER:** Devasmita Chakraverty  
**AUTHORS/INSTITUTIONS:** D. Chakraverty, Teaching and Learning, Washington State University, Spokane, Washington, UNITED STATES|D.B. Jeffe, Washington University School of Medicine, St. Louis, Missouri, UNITED STATES|R.H. Tai, University of Virginia, Charlottesville, Virginia, UNITED STATES|
ABSTRACT BODY:

**Purpose:** MD-PhD dual-degree programs provide physician-scientists the skills to address scientific questions based on clinical experience through a lengthy training period, including a pre-clinical (MD) phase (2 years), research (PhD) phase (≥4 years), and clinical (MD) phase (2 years) preparing students for residency. Given the length, high costs and requirement to switch back and forth between phases, many struggle with training and transitioning these phases. About 25% students seriously consider leaving the program at some point, and 3-34% actually do. Attrition can occur due to many factors.

**Approach/Methods:** Following IRB approval, we conducted a qualitative study from 2011-2013, examining factors that influence the decision-making of MD-PhD students who discontinue training and the alternative pathways they choose. Using purposeful and snowball sampling across U.S. institutions, we contacted and conducted 60-minute, semi-structured telephone interviews with four students, two faculty, and one researcher who started MD-PhD training but discontinued without completing it. We audio-recorded interviews and transcribed them verbatim for inductively derived themes. Following in-depth coding and data categorization, we used a multiple case-study approach to understand the complex phenomena of MD-PhD-program attrition.

**Results/Outcomes:** Reasons to pursue MD-PhD included helping people, practicing medicine, research and teaching simultaneously, deeper engagement with a subject through research, and keeping career interests broad. Six out of seven participants shifted to MD-only track and one left the program entirely. Four left after the first year of PhD training, and the rest after the fourth, fifth, and sixth research year.

Reasons for leaving included gap in medical training after second year for pursuing research, research projects not fitting to clinical training, “cold wars” between MD and PhD faculty (emphasizing the need for MD-PhD faculty), isolation from family (worsened by the length of training), enjoying doctor-patient interaction more than the isolation of research, not finishing PhD research on time due to lack of adviser support, and lack of socialization due to the solitary nature of PhD training. Some wanted to pursue research in the future, but not as PhDs. Overall, there were differences in the nature of mentoring by MD and PhD faculty. Participants were drawn more to clinical medicine and voiced the need for MD-PhD mentors. As first-generation college students, most participants relied heavily on mentor support.

Every participant discussed lack of adequate MD-PhD mentors, especially female and underrepresented minority MD-PhD mentors to advise on work-life balance, strained relationships with PhD mentors who did not provide hands-on training or other resources to allow timely completion of the PhD.

Other hindrances included lengthy training time (especially for women), raising families during training (penalizing women more), lack of academic socialization and of support during different program phases.

**Discussion:** Findings advance our understanding about why some MD-PhD students left before completing training and how institutional experiences contributed to MD-PhD-program attrition. A strong social network (peers, MD-PhD mentors) can make transitions and integration in different phases easier.

**Significance:** We highlight the need to develop better supports in MD-PhD programs, especially focusing on recruiting more MD-PhD mento to better support trainees during the different phases.

**References:**


**Level of Audience:** Early-career  
**Focus of Presentation:** GME  
**PRESENTER:** Devasmita Chakraverty  
**AUTHORS/INSTITUTIONS:** D. Chakraverty, Teaching and Learning, Washington State University, Spokane, Washington, UNITED STATES|D.B. Jeffe, Washington University School of Medicine, St. Louis, Missouri, UNITED STATES|R.H. Tai, University of Virginia, Charlottesville, Virginia, UNITED STATES|