

ORIGINAL RESEARCH

A Summary Report from the Research Partnership on Women in Science Careers

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BACKGROUND: In response to the landmark report “Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering,” the NIH Office of Research on Women's Health issued a request for applications that funded 14 R01 grants to investigate causal factors to career success for women in STEM. Following completion of the 4-year grants, the grant PIs formed a grassroots collaborative, the Research Partnership on Women in Science Careers.

OBJECTIVE: To summarize the work of the Research Partnership, which resulted in over 100 publications.

METHODS: We developed six themes to organize the publications, with a “Best Practices” for each theme at the end of each section: Barriers to Career Advancement; Mentoring, Coaching, and Sponsorship; Career Flexibility and Work-Life Balance; Pathways to Leadership; Compensation Equity; and Advocating for Change and Stakeholder Engagement.

RESULTS: Women still contend with sexual harassment, stereotype threat, a disproportionate burden of family responsibilities, a lack of parity in compensation and resource allocation, and implicit bias. Strategies to address these barriers using the Bronfenbrenner ecological model at the individual, interpersonal, institutional, academic community, and policy levels include effective mentoring and coaching, having a strong publication record, addressing prescriptive gender norms, positive counter-stereotype imaging, career development training, networking, and external career programs such as the AAMC Early and Mid-Career Programs and Executive Leadership in Academic Medicine (ELAM).

Research Highlights

- Barriers to Career Advancement
- Mentoring, Coaching and Sponsorship
- Career Flexibility and Work-Life Balance
- Pathways to Leadership
- Compensation Equity
- Advocating for Change and Stakeholder Engagement

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CONCLUSIONS: Cultural transformation is needed to address the barriers to career advancement for women. Implementing the best practices noted of the work of the Research Partnership can help to achieve this goal.

KEY WORDS: women's careers; biomedical sciences; leadership; mentoring; work-life balance; institutional climate.

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BACKGROUND

Despite four decades of increasing numbers of women in academic medicine, their proportions remain low in senior academic rank and leadership positions.¹ Women face barriers including an academic structure and culture that has been difficult to change, a deeply entrenched faculty value system, and ingrained sociocultural norms that define social roles, and impede organizational innovation and leadership diversity.²

In 2006, the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine published a landmark report: “Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering.”³ Produced by the Committee on Science, Engineering, and Public Policy and chaired by the former Secretary of Health and Human Services, Donna Shalala, the document underscored that “the United States economy relies on the productivity, entrepreneurship, and creativity of its people... to maintain its scientific and engineering leadership amid increasing economic and educational globalization, the United States must aggressively pursue the innovative capacity of all its people—women and men.” In response, the NIH Office of Research on Women's Health funded 14 R01 grants to investigate causal factors to career success for women in Academic Science and Engineering. The 14 NIH R01 Research Partnership grantees (listed online in Appendix 1) embarked on studies, some of which defined the current issues for women, and others that tested interventions to address barriers. As of this writing, over 100 manuscripts, including a special collection in

2016 in *Academic Medicine*⁴ and in 2017 in the *Journal of Women's Health*⁵, have been published by the grantees.

METHODS

Following completion of the 4-year grants, the PIs formed a grassroots collaborative, the “Research Partnership on Women in Science Careers”, co-chaired by three of the authors (PC, DH, AV) to increase the impact of their work and share best practices. One of the co-chairs of the Research Partnership (PC) obtained a grant from the Doris Duke Charitable Foundation to hold an onsite meeting at the Washington, D. C. headquarters of the Association of American Medical Colleges (AAMC) in the Spring of 2017 for the PIs to discuss next steps in their work, prioritize areas of impact, and discuss best practices and dissemination strategies. Attendees chose broad topics in which they had research expertise to work in subgroups to review and prioritize their published work. Six themes were subsequently chosen by the authors as best representative of the Partnership’s impact. The five dominant themes covered 51 publications that fell into broad categories: (1) Barriers to Career Advancement, (2) Mentoring, Coaching, and Sponsorship, (3) Career Flexibility and Work-Life Balance, (4) Pathways to Leadership, and (5) Compensation Equity. The direction to the subgroups was to consider ways from the sixth theme to Advocate for Change and Stakeholder Engagement. The social ecological model was used to look at the level of impact of interventions as being at the individual, interpersonal, institutional, academic community, and policy levels to frame the research.⁶ Each theme was evaluated for the most appropriate level(s) in the model. The purpose of this article is to summarize the findings, identify evidence-based best practices for gender equity and provide direction to develop, and eventually evaluate the impact of interventions at all five levels of influence within and among institutions.

BARRIERS TO CAREER ADVANCEMENT

In a qualitative study at 23 medical schools, members of the Group on Women in Medicine and Science (GWIMS) and the Group on Diversity and Inclusion (GDI) of the AAMC were interviewed. Five issues emerged from this study: (1) a wide spectrum in the gender climate at institutions; (2) a lack of parity in rank and leadership by gender; (3) a lack of retention of women in academic medicine (the “leaky pipeline”); (4) a lack of gender equity in compensation; and (5) a disproportionate burden of family responsibilities. The key informants saw only modest improvements in the academic climate for women over the past 20 years, and a lack of institutional oversight, with substantial variations by department.⁷ Thus, barriers to career advancement still clearly remain.

Although declining, sexual harassment is still common in academic settings as in other occupations. In a recent study, 30% of junior research physicians reported experiences of sexual harassment.⁸ This has fallen from 52% in 1995.⁹ However, as there were greater proportions of women in medical schools for the more recent cohort (>40%), one would have expected a much greater decline in sexual harassment.⁸ “Stereotype threat” has also affected women faculty, as women are often characterized by negative stereotypes, which can influence them to underperform. Over thirty years of research confirms that gender stereotypes can disadvantage women’s advancement in science and medicine.² Women faculty have fewer publications than men (relative number = 0.71; 95% CI = 0.63, 0.81; $P < 0.0001$) and their publications have lower impact, with fewer citations or h-index (relative number = 0.81; 95% CI = 0.73, 0.90; $P < 0.0001$).¹⁰ Women with more publications are more likely to be retained and to advance to full professor than women with fewer publications.¹

In a qualitative study examining medical faculty programs for gender equity in recruitment, retention, and promotion, 9 of 23 institutions did not have specific programs for women. Where programs existed, they targeted the individual, interpersonal, and institutional levels of the social ecological model,¹¹ with many fewer at the academic community and policy levels (see Fig. 1), even though women attending programs (the AAMC Early and Mid-career and ELAM programs) reported developing important leadership skills.¹²

Women of color are more underrepresented at higher ranks: 18% of the US population are minority women, but they represent just 3.2% of full professors. There has been limited attention to the specific issues and double jeopardy they face.¹³ Higher workplace discrimination and work-family conflict contribute to a negative climate for women of color.¹⁴

Women STEM faculty are more likely to leave their occupational field than professional medical women, although they do not exit the labor force.¹⁵ Among those who majored in STEM fields, there were no differences between men and women in transitioning into academic STEM jobs.¹⁵ Men had more conventional gender ideologies than their women counterparts. Marriage and family expectations were more traditional in male faculty. This difference may explain why women in STEM find a less welcoming environment.¹⁵

Best Practices

Addressing sexual harassment with zero tolerance policies, and sex stereotype threat with stereo-replacing, positive counter-stereotype imaging, and perspective taking (see p.10) can improve these behaviors. Senior faculty who mentor early- and mid-career women should focus on increasing their publication productivity, and provide encouragement and institutional support to participate in leadership development programs (AAMC Early and Mid-career and ELAM programs).

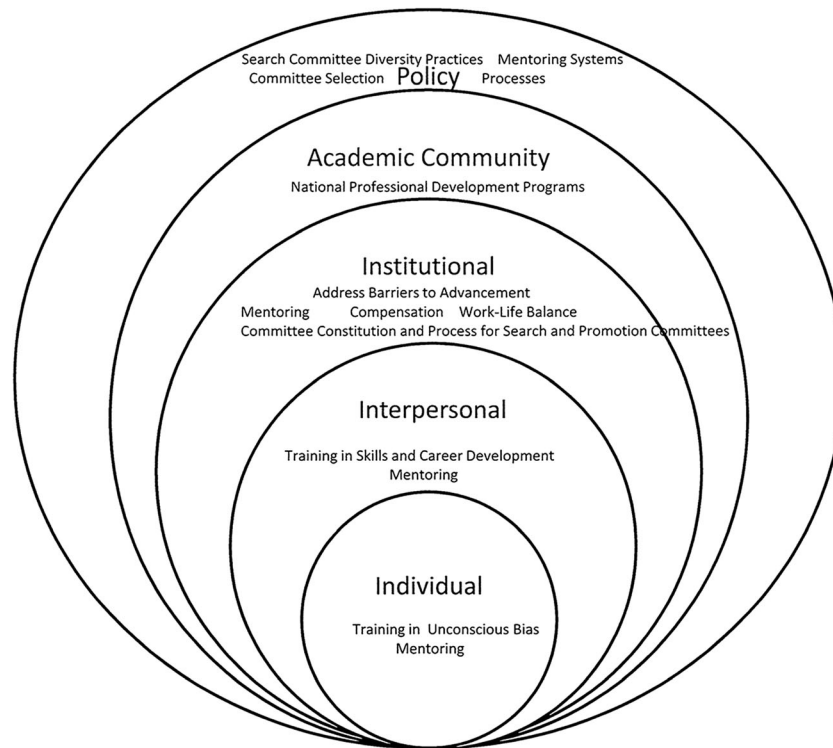


Figure 1 Social ecological model of the potential levels of interventions for gender Equity in academic medicine.

MENTORING, COACHING, AND SPONSORSHIP

A lack of access to and support from mentors is a barrier to the career success of women.^{16, 17} McGee et al. used different social science theories to deconstruct mentoring roles, and the differential impact on women and URM scientists (at the interpersonal level^{18–21} (Text Box 1). To be most effective, mentors must understand, acknowledge, and be sensitive to the complex challenges faced by women and URM students, including experiences of isolation, discrimination, and stereotyping. An advisory committee to the NIH recommended that institutions have formal mentor training programs to address all aspects of mentoring.²²

Text Box 1. Important aspects of mentoring for women and women of color

Lack of access to and support from mentors
 Coaching, including coaching from an outside institution
 Understanding the complex challenges faced by women and women of color
 Address isolation, discrimination, and stereotyping
 Achieve a strong support network
 Have a mentor in the same department/institution
 Have a mentor similar in race for racial minorities and foreign-born faculty
 Have a network of mentors including peer mentors and mentors who are diverse in expertise, rank, and gender
 Have a mentor with high prestige
 Have collegiality in the mentoring relationship

A novel mentoring/coaching model for female graduate students, including racial minorities, was designed for

personal support to combat isolation. Graduate students and/or postdocs were joined by a coach to form a group of 6–10 individuals outside of their institutions^{23–25} to achieve a strong support network.

In a study of medical faculty mentoring preferences, women across an array of medical institutions ranked the importance of mentor similarity on several characteristics. Faculty ranked having a mentor in the same department and institution as their top priority. Similarity in race was rated as least important except for minority and foreign-born faculty.²⁶ A mentoring study among a diverse national sample of male and female clinician-researchers in formal mentoring relationships found that the traditional dyad was inadequate. Faculty needed a network of mentors: peer mentors and others with diversity in expertise, rank, and gender.²⁷ In another study of mentoring satisfaction, 1227 clinician-researchers with NIH career development awards found that greater time with the mentor, higher mentor prestige, and collegiality of the relationship were associated with greater career satisfaction.²⁸

Sponsorship is another important avenue to improve the numbers of women in senior positions. In work by Travis, neither formal mentoring programs nor executive coaching led to increases of women in top leadership. Sponsorship programs were designed to accelerate the careers of women as leaders. Different from mentors, who work closely with faculty to enhance their research and education skills, sponsors have position and influence to advocate publicly for advancement of talented women to senior leadership positions.²⁹

Best Practices

Mentoring networks which include peers and diversity in expertise, rank, and gender were significant factors in successful mentoring.²⁷ Mentoring should be adaptable to the career stage and interests of the mentee. Coaches with 6–10 others from outside institutions should be engaged to provide greater diversity of mentoring support to racial and ethnic minority faculty. Formal policies should address having culturally, racially, and ethnically appropriate mentors for women of color. Sponsorship provides another means for senior faculty in positions of power and influence to advocate for talented women and women of color to be considered for senior leadership positions.²⁹

CAREER FLEXIBILITY AND WORK-LIFE BALANCE

Women in biomedical careers spend greater time on children and domestic responsibilities compared to men. Attitudes, values, and expectations of work and family roles differ by gender,³ and female gender is inextricably linked to multiple life roles.

In qualitative interviews with NIH K-awardees, Strong et al.³⁰ noted that early career stage faculty and women were more likely to view work-life balance as a priority. Jolly et al. found that among high-achieving physician-scientists, women with children reported spending 8.5 hours per week more on parenting and/or domestic activities than men.³¹ Beckett et al. found that faculty with both child-care and clinical responsibilities were significantly more likely to report low satisfaction with work-life balance and career compared to colleagues without children and/or clinical responsibilities.³²

Villablanca et al. found that flexibility policies (institutional level) were perceived as important for recruitment, retention, and career satisfaction.³³ Howell et al. reported that policies were viewed as particularly important by women and younger faculty (age < 50). Younger men (age < 50) and older women (age > 50) faculty appeared least satisfied and showed lower overall career satisfaction,³⁴ indicating that flexibility is important to a broad range of faculty. Despite the perceived importance of such policies, a lack of policy awareness and utilization was noted. Gunn et al. conducted interviews with 22 GWIMS representatives and senior leaders, finding that only 9 of the 22 interviewees (all women) could accurately describe institutional policies.³⁵ Villablanca et al. noted a lack of awareness and use of family-supportive policies.³³

Real and perceived barriers to the utilization of flexibility policies were evident. Even when flexibility policies were available, there was cognitive dissonance for their use with concern for negative personal or professional repercussions. The stigma of being perceived as less committed to one's career^{30, 31, 33–36} and concern about slowed career progress from “mommy tracking”^{30, 33} were concerns. Inconsistent awareness and implementation of policies and unsupportive department heads were also considerations.^{30, 33} For those

with grant-funded research, financial concerns of reduced salary from not bringing in grants because of leaves were also factors.^{30, 36} Faculty were concerned about overburdening colleagues and the impact to collegial relationships.^{33, 36} Women were more likely than men to not use policies despite wanting to.³⁷

Villablanca et al. launched a 2010 longitudinal accelerator intervention to enhance knowledge, awareness, and use of flexible policies using six communication elements: (1) informal workshops; (2) designated departmental faculty liaisons; (3) didactic presentations; (4) enhanced web presence; (5) social media; and (6) print communication. One year later, there was greater awareness of policies but also greater perceived barriers to use.^{38, 39} Qualitative analysis of faculty surveys found that utilization of flexibility benefits was inhibited by organizational influences: the absence of reliable information about eligibility, workplace cultures that stigmatized program participation, the influence of uninformed or unsupportive department heads, and concerns about burdening co-workers.³⁹

Best Practices

Work-life balance is an important issue for all faculty, and a strategic tool for recruitment of top talent, retention, and faculty satisfaction. For policies to have optimal impact, top leadership will benefit from addressing barriers to policy awareness and engage department chairs to facilitate their use. Childcare Leave and Stop the Clock should be “opt-out” instead of “opt-in.” Onsite child and elder care and broadening leaves for family members with serious illness, catastrophic events such as a fire, divorce, or custody disputes are additional considerations for leave policies. Promotion and tenure should be the same for all faculty regardless of the use of leaves. Part-time tenure tracks should be offered by institutions offering tenure.

PATHWAYS TO LEADERSHIP

Studies from the Research Partnership evaluated career outcomes of women who attended the AAMC's Early and Mid-Career Professional Development Seminars and Drexel University's Executive Leadership in Academic Medicine (ELAM) over a 15-year period.¹² Using a conceptual framework, the Systems of Career Influences Model, Helitzer and colleagues outlined a series of questions to understand women's trajectories.⁴⁰ Attendees of national programs reported increased general leadership skills and specific skills (individual level): managing difficult conversations and interpersonal relationships, effective negotiation, and network building.¹² Carnes and colleagues explored the role of endowed chairs in Women's Health and found this to be an additional vehicle to increase women in leadership.⁴¹

Grisso and colleagues conducted a randomized controlled intervention to improve leadership and career success for

women assistant professors. This multifaceted intervention addressed cultural barriers to women's career advancement.⁴² In the intervention departments/divisions, women assistant professors participated in extensive professional development: manuscript writing peer groups; and "Total Leadership"—a program for leadership development in all life areas. Task forces in departments/divisions designed initiatives to address the needs of women faculty. The dean, chairs, and chiefs provided support for these initiatives. The result was a broad culture change in both the intervention and control departments/divisions,⁴³ suggesting that there were external factors that affected the control departments which benefitted from the overall culture change.

Best Practices

Institutions that encourage women to participate in internal and external leadership programs and create opportunities for endowed chair positions create paths to leadership for women through skill building and elevating their status. It is also important to facilitate networking for women at the interpersonal level as this is key to an academic career. Providing institutional databases by area of expertise can promote important collegial contacts that can further careers. Interventions targeting culture change may have benefits that affect the entire institution and not just the targeted group(s).

COMPENSATION EQUITY

The gender gap in compensation has been well documented⁹ as an ongoing policy issue across multiple workforce sectors, from blue- and pink-collar (traditionally held by women) positions to elite athletes and actors. National data documents that women currently earn 83 cents on the dollar compared to men.⁴⁴

To conduct appropriate analyses in physician salaries requires controlling for work effort, specialty type, seniority, and distribution of effort. A 17-year follow-up of the National Faculty Survey demonstrated that women in academic medicine earn 90 cents on the dollar compared to men, and that a wage gap persists after controlling for hours worked, specialty, and distribution of work across clinical care, research, education, and administration.⁴⁵ Jagsi and colleagues addressed confounding variables by looking at elite early stage physician-researchers with competitive NIH awards. The authors found that male gender remained an independent significant predictor of salary (wage gap of \$10,921/year, $P < 0.001$) even after adjusting for specialty, academic rank, work hours, and research time.⁴⁶

Best Practices

The Research Partnership did not test interventions for the compensation gap. However, key GWIMS informant interviews suggested a variety of multi-level

interventions: strong negotiating skills on the individual level, mentoring and women in medicine committees at the interpersonal level, and oversight of all offers of recruitment for compensation and resource equity at the institutional level.⁴⁷ At the policy level, funding agencies should make grant funding contingent on institutional gender and minority equity plans.

ADVOCATING FOR CHANGE AND STAKEHOLDER ENGAGEMENT

Implicit gender bias persists, constraining the advancement of women in STEM. However, implicit bias is a habit that can be broken.⁴⁸ Successful habit-changing interventions increase awareness of problematic behavior and motivate individuals to learn and practice new behaviors until they become habitual.⁴⁸

Carnes et al. reviewed stereotype-based gender bias and its detrimental effects on women. They looked at bias literacy: expectancy bias (group stereotype expectations); prescriptive gender norms (how men and women should behave); occupational role congruity (advantage accrued to men as scientist and leader); redefining credentials (a credential valued differently depending on who has it); stereotype priming (subtle reminders of male and female stereotype); and stereotype threat (leading to underperformance). The authors then assessed five evidence-based behaviors to promote self-efficacy for overcoming gender bias: stereotype replacing (with accurate information); positive counter-stereotype imaging (a woman in a position usually held by men); perspective taking (what it is like to be in a stereotyped group); individuation (information to prevent stereotyping); and increasing contact with counter-stereotypic senior women faculty.⁴⁹ These issues were addressed in a 2½ hour workshop and assessed at 1 and 3 months, showing a persistent benefit.

Others have similarly demonstrated that intentional behavior change through an intervention can increase awareness of gender bias and promote an inclusive climate.⁵⁰ In response, institutions have conducted workshops for faculty search committees to counteract unconscious bias.⁵⁰ The University of Minnesota College of Biological Sciences utilized implicit bias training from the Society of Neurosciences "Women in Neuroscience" workshops. They also used a nationally known photographer to spark discussion about perception, identity, and bias. From these interventions, the interview pools became more diverse: up to 55% women. Of fourteen faculty hires over two years, six were women.⁵¹

Best Practices

Institutions now have evidence-based tools (Text Box 2) to address implicit bias. Such strategies have the potential to

diversify the biomedical workforce, improving institutional climate and promoting gender equity.

Text Box 2. A tool box for gender equity

Implicit gender bias
Solutions
Stereotype replacing with accurate information
Positive counter-stereotype imaging
Placing a woman in a position usually held by a man
Perspective taking
What it is like to be in a stereotyped group
Individuation
Information to prevent stereotyping
Increasing opportunities with counter-stereotypic senior women faculty

SUMMARY AND NEXT STEPS

Studies of the Research Partnership encompass many aspects of women in academic careers, elucidating barriers to advancement, including sexual harassment and stereotype threat, a disproportionate burden of family responsibilities and a lack of gender parity in compensation. Strategies to impact these barriers include effective mentoring/coaching, strong publication records for women, addressing prescriptive gender norms, positive counter-stereotype imaging, networking, and external career programs, which provide valuable skill training. However, they don't impact the hierarchical culture of academic medicine. Frameworks are needed that include a more latticed approach to leadership opportunities for women.

Our research provides a deeper understanding of obstacles that women face in academic health sciences. More importantly, they provide a tool box of evidence-based solutions at all levels of the ecological model to bring diverse voices to the table for the academic missions of excellence in research, clinical care, and education. Many of these interventions are directed at the individual or interpersonal level of the ecological model (Fig. 1), but they also provide opportunities for change at the institutional, academic community, and policy levels. Below are examples of interventions at each level:

At the institutional level: (1) Supporting formal mentor training that is rewarded with mentor advancement; (2) Having zero tolerance for sexual harassment; (3) Gender equity in initial startup resource and salary packages; (4) Creating a favorable atmosphere for work-life balance and addressing barriers to policy use; (5) Faculty training in implicit bias especially for search and promotion committees; and (6) Prioritizing women to attend national professional development programs.

At the academic community level: (1) Strengthen and expand career development programs such as the AAMC Early and Mid-Career and ELAM programs, (2) Further studies of the outcomes of women attendees to understand the most effective aspects of these programs, (3) Change our perceptions of what a leader is and embrace diversity as a driver of change and vision, and (4) Develop a team and latticed leadership model to provide a breadth of opportunities.

At the policy level: Organizations such as AAMC, NIH and AHC can (1) promulgate specific gender equity criteria for institutions to receive grant funding and awards; (2) reward institutions that support women faculty to attend AAMC and ELAM programs; (3) encourage explicit practices for compensation and startup packages; and (4) publish lists of top institutions in achieving a more diverse faculty.

We can achieve the cultural transformation needed in academic science disciplines. Without such a transformation, no substantive change can be achieved. The opportunities exist for senior leaders to create a more diverse and gender equitable climate in biomedical science careers.

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