



HHS Public Access

Author manuscript

Acad Med. Author manuscript; available in PMC 2018 February 01.

Published in final edited form as:

Acad Med. 2017 February ; 92(2): 214–221. doi:10.1097/ACM.0000000000001330.

Team Mentoring for Interdisciplinary Team Science: Lessons from K12 Scholars and Directors

Jeanne-Marie Guise, MD, MPH,

Vice provost, Academic Career Development and Mentorship, and professor, Division of Maternal Fetal Medicine, Department of Obstetrics and Gynecology, Department of Public Health and Preventive Medicine, Department of Medical Informatics and Clinical Epidemiology, Department of Emergency Medicine, Oregon Health & Science University, Portland, Oregon

Stacie Geller, PhD,

G. William Arends Professor, Department of Obstetrics and Gynecology and Center for Research on Women and Gender, University Of Illinois College Of Medicine, Chicago, Illinois

Judith G. Regensteiner, PhD,

Professor, Divisions of General Internal Medicine and Cardiology and the Center for Women's Health Research, University of Colorado, Denver, Colorado

Nancy Raymond, MD, and

Professor, Department of Psychiatry, Powell Center for Women's Health, University of Minnesota, Minneapolis, Minnesota

Joan Nagel, MD, MPH

Medical officer, Division of Clinical Innovation, National Center for Advancing Translational Sciences, National Institutes of Health, Bethesda, Maryland

the Building Interdisciplinary Research Careers in Women's Health Program Leadership

Abstract

Purpose—Mentoring is critical for academic success. As science transitions to a team science model, team mentoring may have advantages. The goal of this study was to understand the process, benefits, and challenges of team mentoring relating to career development and research.

Method—A national survey was conducted of Building Interdisciplinary Research Careers in Women's Health (BIRCWH) program directors, current and former scholars s from 27 active National Institutes of Health (NIH)-funded BIRCWH NIH K12 programs to characterize and

Correspondence should be addressed to Jeanne-Marie Guise, vice provost for Academic Career Development and Mentorship, Oregon Health & Science University, Mail Code L466, 3181 SW Sam Jackson Park Road, Portland, Oregon 97239-3098; telephone: (503) 494-2101; guisej@ohsu.edu.

Supplemental digital content for this article is available at [LWW INSERT LINK].

Other disclosures: None reported.

Disclaimer: The findings and conclusions in this document are those of the authors and do not represent the official policies of the Office of Research on Women's Health or National Institutes of Health.

Previous presentations: Preliminary results presented at BIRCWH Annual Meeting, October 2014, National Institutes of Health, Bethesda, Maryland

understand the value and challenges of the team approach to mentoring. Quantitative data were analyzed descriptively and qualitative thematically.

Results—Responses were received from 25/27 (93%) of program directors, 78/108 (72%) current scholars, and 91/162 (56%) former scholars. Scholars reported that team mentoring was beneficial to their career development (152/169, 90%) and research (148/169, 88%). Reported advantages included a diversity of opinions, expanded networking, development of stronger study designs, and modeling of different career paths. Challenges included scheduling and managing conflicting opinions. Advice by directors offered to junior faculty entering team mentoring included: not to be intimidated by senior mentors, be willing to navigate conflicting advice, be proactive about scheduling and guiding discussions, have an open mind to different approaches, be explicit about expectations and mentors' roles (including importance of having a primary mentor to help navigate discussions), and meeting in person as a team.

Conclusions—These findings suggest that interdisciplinary/interprofessional team mentoring has many important advantages, but that skills are required to optimally utilize multiple perspectives.

The increasing complexity of science, technology, and issues facing society has created a demand for integrated interdisciplinary research teams to understand and solve these problems.^{1,2} Although in the United States an expectation of team science is becoming more common, little is known about the effects of interdisciplinary team mentoring on the development of junior researchers and what it takes to prepare trainees and faculty for this team discovery environment.

The Building Interdisciplinary Research Careers in Women's Health (BIRCWH) program, developed by the National Institutes of Health (NIH) Office of Research on Women's Health (ORWH), has demonstrated success for individual scholars (as assessed by funding rates, publications rates, and other outcomes) and for increasing the emphasis on team mentoring at an institutional level.³ This program, funded at 27 sites across the United States, is designed three pillars: career development, mentoring, and interdisciplinary research; and is one of the longest running interdisciplinary mentoring programs in biomedical science. While there are differences in scientific focus and administrative details across participating institutions, all provide 75% protected time for faculty to pursue research in women's health or sex differences, require interdisciplinary team mentoring, and have shared investments between NIH and the institution.

Mentoring has been repeatedly demonstrated to play a critical role in academic success. Fellows and faculty who are mentored are more likely to pursue and remain in an academic career,^{4–7} report greater job satisfaction (2-fold increase for fellows),^{5,8} experience improvements in annual performance reviews (56% improvement in research, 26% in teaching and 6% in patient care),⁹ and are more than two times more likely to be promoted to professor.¹⁰ Mentoring has been shown to have a particularly important role in influencing the selection of research as a career, shaping research careers, increasing the allocation of time to research,^{11–18} and increasing academic productivity.^{17, 19–23} In addition, faculty who are mentored are 2–3 times more likely to become a principal investigator (PI) on research grants.^{17, 23} These studies examined the influence of the

traditional mentor-mentee dyadic relationship. Despite a relative dearth of quantitative evaluation of team mentoring experiences, team mentoring continues to be a critical element of training programs for the inter- and transdisciplinary research work force. While there are validated tools to evaluate the individual mentor-mentee relationship,^{24–27} it is not known whether being mentored by teams further amplifies these positive findings of mentoring or has negative effects.

As healthcare education and science moves towards interdisciplinary and interprofessional models, there is increasing interest in the competencies required for researchers to be successful in team science and how to cultivate them.²⁸ Identified competencies for interdisciplinary team science include being able to use theories, methods, and concepts from different disciplines, demonstrating respect for other disciplines, successfully communicating with other disciplines, and collaborating with people from other disciplines to develop an interdisciplinary framework.²⁹ It is important to understand training and mentoring approaches that cultivate such competencies. Interdisciplinary mentoring teams may offer advantages for trainees to develop such competencies but they also have the potential to introduce new challenges. Potential advantages include the use of a progressive cutting-edge approach that brings leading scientists from various fields together to tackle complex research topics and a model which builds comfort and fluency working in interdisciplinary teams. Potential challenges include dealing with multiple scientific “languages” and approaches that raise challenges for scholars and require navigating differences and conflict among the research team.

The purpose of this study was to characterize the process, advantages, and challenges of team mentoring to career development and research, as described by interdisciplinary research program directors and past and current scholars.

Method

We conducted a national survey of directors and active and former BIRCWH K12 scholars from the 27 current BIRCWH programs from October 3–17, 2014. We contacted BIRCWH directors by email through the NIH BIRCWH PD/PI listserv and sent them one reminder inviting their participation in a survey to understand team mentoring practices and evaluation among BIRCWH sites. The email included an information sheet about the study, a link to a director’s survey (see Supplemental Digital Appendix 1 [LWW INSERT LINK]), and a request for the director to forward an invitation to a total of 10 scholars including all 4 current scholars as well as 6 recent past scholars in their program to complete a scholar’s survey (see Supplemental Digital Appendix 2 [LWW INSERT LINK]). All correspondence including invitation and reminders were distributed through BIRCWH directors. Current and past scholar participation was limited to 10 per site in order to allow for equal representation among all 27 sites. The study was approved by the Oregon Health & Science University Institutional Review Board (IRB Number: 00011114).

Surveys contained both structured and unstructured questions seeking to assess mentoring practices. The first page of the survey contained an information sheet and consent was given by clicking forward to take the survey. Survey questions were developed by one of the

authors is a BIRCWH Program Director (JMG), distributed to co-authors who are also BIRCWH Program Directors (SG, JR, NR) for face validation, and reviewed by an evaluation expert. Survey topics included the backgrounds of the mentors or scholars, frequency and nature of meetings, the degree to which team mentoring provided benefits and/or challenges to career development and research, communication issues, and experiences and frequency of disagreements among mentors or mentors and scholars. We also asked respondents to provide 3–10 bullet points summarizing their observations about what leads to successful team mentoring, what leads to problems with team mentoring, advice for new scholars regarding team mentoring, and suggestions on how to evaluate team mentoring. All surveys were administered using SurveyMonkey.

Qualitative analyses adhered to processes believed to produce methodologically sound qualitative research, including independent review of texts, thematic coding by two trained reviewers, and triangulation across a multi-disciplinary research team.^{30,31} Responses to open-ended questions were imported into NVivo9 software (QSR International, Cambridge, MA) and thematically coded independently by two objective research associates with training in conducting qualitative analyses. Because the practice of team mentoring is still developing, our analysis was guided by principles of grounded theory, wherein an understanding of the concept of interest arises from the empirical data rather than from a priori hypotheses.³⁰ We globally reviewed narrative responses to identify initial themes and then re-reviewed in more detail to identify subthemes. Themes and subthemes were reviewed in detail by the lead investigator with training in qualitative analysis and by a multidisciplinary group at the national meeting of BIRCWH Program Directors in 2014.

Results

Twenty-five of 27 programs (93%) responded to the program director (PI/PD) survey and had at least one current scholar complete the scholar survey (range 0–6 current scholars per program). Twenty-four of 27 programs (89%) had at least one former scholar complete the survey (range 0–7 former scholars/program). In total, 78 of 108 potential current scholars (72%) and 91 of 162 potential former scholars (56%) completed the survey, with a median total scholar participation of 6 per program (range 0–10). The gender distribution of respondents reflected national BIRCWH statistics with 139 (84%) scholars being female (compared with 80% nationally).³

Because there are logistic considerations in scheduling with many mentors, we asked scholars how frequently they met with their mentoring teams. Meeting practices varied widely, ranging from weekly to annually with the most common being monthly, quarterly, or semi-annually. Scholars reported having between 2–7 mentors, with most having between 2–4 mentors and 25–30% having at least one off-site mentor. Ninety percent of scholars reported that team mentoring was beneficial to their career development (152/169) and research (148/169).

Program directors, current, and former scholars all reported that in-person meetings were the most effective method for team mentoring (86% of program directors (25), 80% of current scholars (78), and 73% of former scholars (91)). Factors determining whether the team met

in-person included scheduling, whether the program required in-person meetings, whether there was perceived benefit from prior meetings, and whether the scholar had a specific need. Of the 63 former and 59 current scholars who described topics covered during group meetings, 50% (31/63) of former and 63% (37/59) of current scholars provided updates on their K12 project; 17% (11/63) of former and 17% (10/59) of current scholars discussed research methods or analysis; 19% (12/63) of former and 8% (5/59) of current scholars discussed career development including promotion; 11% (7/63) of former and 8% (5/59) of current scholars discussed grant planning; and 3% (2/63) of former and 2% (1/59) of current scholars reported working on publications.

In order to understand the benefits and challenges of team mentoring, program directors and scholars were asked to provide 3–10 bullet points on what makes team mentoring effective and what prevents it from being effective. Themes are presented in Table 1. Interestingly, many of the putative strengths of team mentoring were also mentioned as challenges. This included such issues as receiving multiple opinions, in-person team meetings, and scholar and/or mentor preparation for meetings. Scholars commented that it can be difficult given their junior status and inexperience for them to navigate conflict, especially when it arises between senior experienced mentors.

Given that the interdisciplinary team environment was likely unfamiliar to new faculty, we asked program directors and scholars for advice they would give to new scholars regarding team mentoring; these themes are presented in Table 2. Directors and scholars agreed on the importance of being open-minded listening to the diversity of opinions, choosing mentors wisely considering their existing skills and relationships, having clear expectations, being proactive about scheduling ahead and guiding meetings, and the importance of meeting in person.

Because current evaluation tools do not specifically address team mentoring, we also asked program directors and scholars to suggest questions to evaluate team mentoring (Table 3). While many of the proposed questions were common to the traditional dyadic mentoring model, some added unique dimensions to the traditional element, for example, looking at the number and disciplines of authors on research grants and publications as a way to evaluate the expansion of the scholar's research network in addition to simple counts of the numbers of publications and grants. In addition, some of the questions were uniquely distinct to team mentoring, including questions about the frequency of disagreements and frustration; methods by which the scholar navigated conflicts; the degree to which mentors engaged individually and collectively to mentor the scholar; and whether scholars would choose individual versus team mentoring in the future. Scholars were also asked if they would have had an interdisciplinary mentoring team available to them if not for the BIRCWH program.

Discussion

Team science is rapidly becoming the preferred model for addressing increasingly complex scientific questions. It is also a key component of success in the current competitive funding environment. Team theory suggests that developing the interpersonal competencies and an open-mindset toward the challenges of interdisciplinary work are critical components to

success in team science.^{29,32,33} Skills necessary to function successfully in a team, such as managing a team of individuals with diverse backgrounds and differing approaches to research, are best learned by working with teams during training and in the early years of one's career. The interdisciplinary team mentoring format of the BIRCWH program models team science and cultivates the skills needed to succeed in the collaborative team science program. With 15 years of successful interdisciplinary team mentoring experience, the structure and process of team mentoring in the BIRCWH program can inform other programs and provide insights into the unique dimensions of team mentoring that should be considered in mentoring programs and mentoring evaluations. Scholars who effectively learn to navigate an interdisciplinary mentoring team have the advantages of expanding their research networks and taking advantage of resources not only in their own departments but also with regard to resources and collaborators in other departments and schools. Figure 1 illustrates how BIRCWH programs expand research networks for their scholars. Learning to navigate collaborations and mentoring relationships with faculty from other disciplines and to work across these differences is critical to being a successful team scientist. Thus, training programs such as the BIRCWH program serve as good platforms for training team scientists. Many new research collaborations have been formed among scholars, between scholars and mentors, and among mentors by serving on the mentoring team of a BIRCWH scholar. Scholars have also been connected with key research collaborators locally and nationally by their BIRCWH program, thereby allowing the scholar's research to become more robust and go in unanticipated yet exciting directions.

The majority of scholars reported that team mentoring was helpful to their career development in offering different models of academic success, expanding professional and social networks, and offering a diverse palate of approaches to career opportunities and challenges. Similarly they reported that interdisciplinary teams advanced their science by strengthening study designs, expanding ideas and brainstorming, and bringing expanded credibility to the scholar in areas they are not directly trained in. The National Cancer Institute's (NCI's) TREC (Transdisciplinary Research on Energetics and Cancer) program similarly found advantages to the interdisciplinary research environment, reporting a significant positive correlation between multi-mentoring experiences and transdisciplinary research orientation ($r = 0.58$, $P < .05$) and perceived collaborative productivity ($r = 0.44$, $P < .05$).²⁸ The Association of American Medical Colleges stated "At its best, biomedical and health science training, both through training programs and research project grants, not only creates environments for trainees to develop in-depth discipline-based expertise, but also helps prepare them for a broad diversity of careers, including industry, public policy, and other areas, all of which potentially contribute to health and medicine. Increasingly, young scientists train to work in teams and in collaborations on cross-disciplinary research."³⁴ This report recommended that the NIH Biomedical Workforce Working Group should "Promote training programs with team-based focus, and encourage interdisciplinary training and collaborations."³⁴ Together these views suggest that interdisciplinary team mentoring provides an important learning experience and model for the interdisciplinary research teams that scholars will likely need to be successful in science.

This study has important limitations. Because institutions vary in what year their BIRCWH program first began and also until recently in the number of active scholars, programs were

asked to limit total scholar respondents to ten, to ensure that larger and older programs did not dominate results. While current scholar recruitment was comprehensive, it is possible that directors' selection of former scholars may have been biased. However, directors follow-up with all graduates on a regular basis as part of their annual reporting so it is unclear how likely this might be. An additional limitation is that mentors were not surveyed. The complexity of accounting for multiple comparisons and mixtures of mentors given mentors that may mentor several BIRCWH scholars was thought to be too complicated for this initial study.

Our findings suggest that there are important, unique dimensions to be considered in team mentoring. Even traditional measures such as publications and grants should be expanded beyond simple counts to consider the number of co-authors and authors' disciplines. Social network analysis has been increasingly used to evaluate the number of type of co-authors a scholar has over time to demonstrate an expansion of their research network. The suggestion of BIRCWH directors and scholars to examine the total number of authors on publications as part of scholar and program evaluation is consistent with findings of the NCI's interdisciplinary Transdisciplinary Tobacco Use Research Centers (TTURC). These centers found that the total annual publications, cumulative publications, and average number of authors per publication all were higher in their interdisciplinary TTURCs compared with similarly funded grant types that were not team focused.²⁸ Similarly, scholars involved in team mentoring learn to navigate challenges faced by the scientific community involved in team science including the different languages and approaches between those from different disciplines. Taken to an extreme, lack of these skills can lead to delays in scientific progress; but when these challenges are navigated well, scholars build skills that will benefit them in team science endeavors and increase their overall productivity.

Our findings suggest that like team science, team mentoring requires special skills for the scholar – skills which are often not taught to junior faculty. These are confidence to speak up (not be intimidated), being a proactive advocate for their mentoring experience, scheduling (which is not minor challenge given the stature and busy schedules of their mentors), and being open to looking at issues with a different and sometimes foreign lens. Responses from scholars and directors also suggest that the process of team mentoring may have important operational differences and requirements from the traditional dyadic mentoring model. Their descriptions imply that team mentoring involves a more formalized process where scholars present their findings, challenges, and career plans to the group of mentors and coordinate discussions and feedback. This finding suggests that training and practice in concisely summarizing information, public speaking, presentation skills, and managing group discussions are increasingly important topics for academic education. Institutional infrastructures can help junior faculty by teaching them these skills, giving permission for the junior person to advocate for themselves, and developing clear guidance for mentor and scholar expectations in the team environment (including how they will navigate differences of opinion or conflict) as well as setting an expectation for periodic in-person meetings guided by thoughtful prepared materials on behalf of the scholar. Programs that support team mentoring must therefore monitor for signals of trouble in the team dynamics in order to assist the scholar in successfully navigating to a positive resolution of the conflict. Suggestions on how programs can support career development in the team mentoring/team

science environment included requiring in-person meetings among all mentors to promote communication and shared goals, and paying attention to these meetings as stopping of the meetings may be a signal of troublesome conflict. Additional suggestions for programs to support scholars in a team mentoring environment included assisting in setting clear roles and expectations among the mentoring team, and encouraging the scholars to take full advantage of mentoring team (networking, advice on promotion, research design, journal selection, etc.). Thus, team mentoring poses both challenges and opportunity for scholars. However, by the end of the training both the scholars and mentors often have many new collaborators, new approaches to solving both scientific and interpersonal issues that arise in the pursuit of knowledge through team science, and increased confidence regarding their careers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors would like to thank Ms. Caitlin Dickinson and Thai-Hien Do for their assistance with the qualitative analysis of themes from narrative survey responses.

Funding/Support: Building Interdisciplinary Research Careers in Women's Health (BIRCWH) programs are funded through the National Institutes of Health (NIH) Office of Research on Women's Health and the NIH through the following grants: OHSU K12 HD043488, U Colorado K12HD057022, UIC K12HD055892, U Minn K12HD055887.

Ethical approval: The study was approved by the Oregon Health & Science University Institutional Review Board (IRB Number: 00011114).

References

1. Syme SL. The science of team science: Assessing the value of transdisciplinary research. *Am J Prev Med.* 2008; 35(suppl 2):S945.
2. Stokols D, Hall KL, Taylor BK, Moser RP. The science of team science: Overview of the field and introduction to the supplement. *Am J Prev Med.* 2008; 35(suppl 2):S77–S89. [PubMed: 18619407]
3. Nagel J, Koch A, Guimond J, Glavin S, Geller S. Building the women's health research workforce: Fostering interdisciplinary research approaches in women's health. *Glob Adv Health Med.* 2013; 2:24–29.
4. Pearlman SA, Leef KH, Sciscione AC. Factors that affect satisfaction with neonatal-perinatal fellowship training. *Am J Perinatol.* 2004; 21:371–375. [PubMed: 15476125]
5. Sciscione AC, Colmorgen GH, D'Alton ME. Factors affecting fellowship satisfaction, thesis completion, and career direction among maternal-fetal medicine fellows. *Obstet Gynecol.* 1998; 91:1023–1026. [PubMed: 9611018]
6. Benson CA, Morahan PS, Sachdeva AK, Richman RC. Effective faculty preceptoring and mentoring during reorganization of an academic medical center. *Med Teach.* 2002; 24:550–557. [PubMed: 12450479]
7. Wingard DL, Garman KA, Reznik V. Facilitating faculty success: Outcomes and cost benefit of the UCSD National Center of Leadership in Academic Medicine. *Acad Med.* 2004; 79(suppl 10):S9–S11. [PubMed: 15383376]
8. Osborn EH. Factors influencing students' choices of primary care or other specialties. *Acad Med.* 1993; 68:572–574. [PubMed: 8323652]

9. Illes J, Glover GH, Wexler L, Leung AN, Glazer GM. A model for faculty mentoring in academic radiology. *Acad Radiol.* 2000; 7:717–724. Erratum in *Acad Radiol.* 2000; 7:959. [PubMed: 10987334]
10. Wise MR, Shapiro H, Bodley J, et al. Factors affecting academic promotion in obstetrics and gynaecology in Canada. *J Obstet Gynaecol Can.* 2004; 26:127–136. [PubMed: 14965478]
11. El-Guebaly N, Atkinson M. Research training and productivity among faculty: The Canadian Association of Professors of Psychiatry and the Canadian Psychiatric Association Survey. *Can J Psychiatry.* 1996; 41:144–149. [PubMed: 8722642]
12. Hueston WJ, Mainous AG III. Family medicine research in the community setting: What can we learn from successful researchers? *J Fam Pract.* 1996; 43:171–176. [PubMed: 8708627]
13. Leppert PC, Artal R. A survey of past obstetrics and gynecology research fellows. *J Soc Gynecol Investig.* 2002; 9:372–378.
14. Palepu A, Friedman RH, Barnett RC, et al. Junior faculty members' mentoring relationships and their professional development in U.S. medical schools. *Acad Med.* 1998; 73:318–323. [PubMed: 9526459]
15. Pincus HA, Haviland MG, Dial TH, Hendryx MS. The relationship of postdoctoral research training to current research activities of faculty in academic departments of psychiatry. *Am J Psychiatry.* 1995; 152:596–601. [PubMed: 7694910]
16. Shapiro T, Mrazek D, Pincus HA. Current status of research activity in American child and adolescent psychiatry. Part I. *J Am Acad Child Adolesc Psychiatry.* 1991; 30:443–448. [PubMed: 2055882]
17. Steiner JF, Curtis P, Lanphear BP, Vu KO, Main DS. Assessing the role of influential mentors in the research development of primary care fellows. *Acad Med.* 2004; 79:865–872. [PubMed: 15326013]
18. Wakeford R, Lyon J, Evered D, Saunders N. Where do medically qualified researchers come from? *Lancet.* 1985; 2:262–265. [PubMed: 2862430]
19. Paukert JL, Hsieh G. From medical student to intern: Where are the role models? *JAMA.* 2001; 285:2781. [PubMed: 11386938]
20. Levinson W, Kaufman K, Clark B, Tolle SW. Mentors and role models for women in academic medicine. *West J Med.* 1991; 154:423–426. [PubMed: 1877183]
21. Pearlman SA, Leef KH, Sciscione AC. Factors that affect satisfaction with neonatal-perinatal fellowship training. *Am J Perinatol.* 2004; 21:371–375. [PubMed: 15476125]
22. Ramondetta LM, Bodurka DC, Tortolero-Luna G, et al. Mentorship and productivity among gynecologic oncology fellows. *J Cancer Educ.* 2003; 18:15–19. [PubMed: 12825629]
23. Curtis P, Dickinson P, Steiner J, Lanphear B, Vu K. Building capacity for research in family medicine: Is the blueprint faulty? *Fam Med.* 2003; 35:124–130. [PubMed: 12607810]
24. James AS, Gehlert S, Bowen DJ, Colditz GA. A framework for training transdisciplinary scholars in cancer prevention and control. *J Cancer Educ.* 2015; 30:664–669. [PubMed: 25510368]
25. Fleming M, Burnham EL, Huskins W. Mentoring translational science investigators. *JAMA.* 2012; 308:1981–1982. [PubMed: 23168821]
26. Nash JM. Transdisciplinary training. *Am J Prev Med.* 2008; 35(2 Suppl):S133–S140. [PubMed: 18619393]
27. Meagher E, Taylor L, Probsfield J, Fleming M. Evaluating research mentors working in the area of clinical translational science: A review of the literature. *Clin Transl Sci.* 2011; 4:353–358. [PubMed: 22029808]
28. Vogel AL, Feng A, Oh A, et al. Influence of a National Cancer Institute transdisciplinary research and training initiative on trainees' transdisciplinary research competencies and scholarly productivity. *Transl Behav Med.* 2012; 2:459–468. [PubMed: 24073146]
29. Gebbie KM, Meier BM, Bakken S, et al. Training for interdisciplinary health research: Defining the required competencies. *J Allied Health.* 2008; 37:65–70. [PubMed: 18630780]
30. Corbin J, Strauss A. Grounded theory research: Procedures, canons, and evaluative criteria. *Qual Sociol.* 1990; 13:3–21.
31. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res in Psychol.* 2006; 3:77–101.

32. Bedwell WL, Fiore SM, Salas E. Developing the future workforce: An approach for integrating interpersonal skills into the MBA classroom. *Acad Manag Learn Edu.* 2014; 13:171–186.
33. Stokols, D. Training the next generation of transdisciplinary. In: O'Rourke, MO, Crowley, S, Eigenbrode, SD., Wulfhorst, JD., editors. *Enhancing communication and collaboration in interdisciplinary research.* Los Angeles, CA: Sage Publications; 2014. p. 56-74.
34. Request for Information to the Work Force Working Group [letter responding to request for information]. Washington, DC: Association of American Medical Colleges; Oct 7. 2011 <https://www.aamc.org/download/262432/data/aamcrequestforinformationtotheworkforceworkinggroup.pdf>. Accessed May 28, 2016

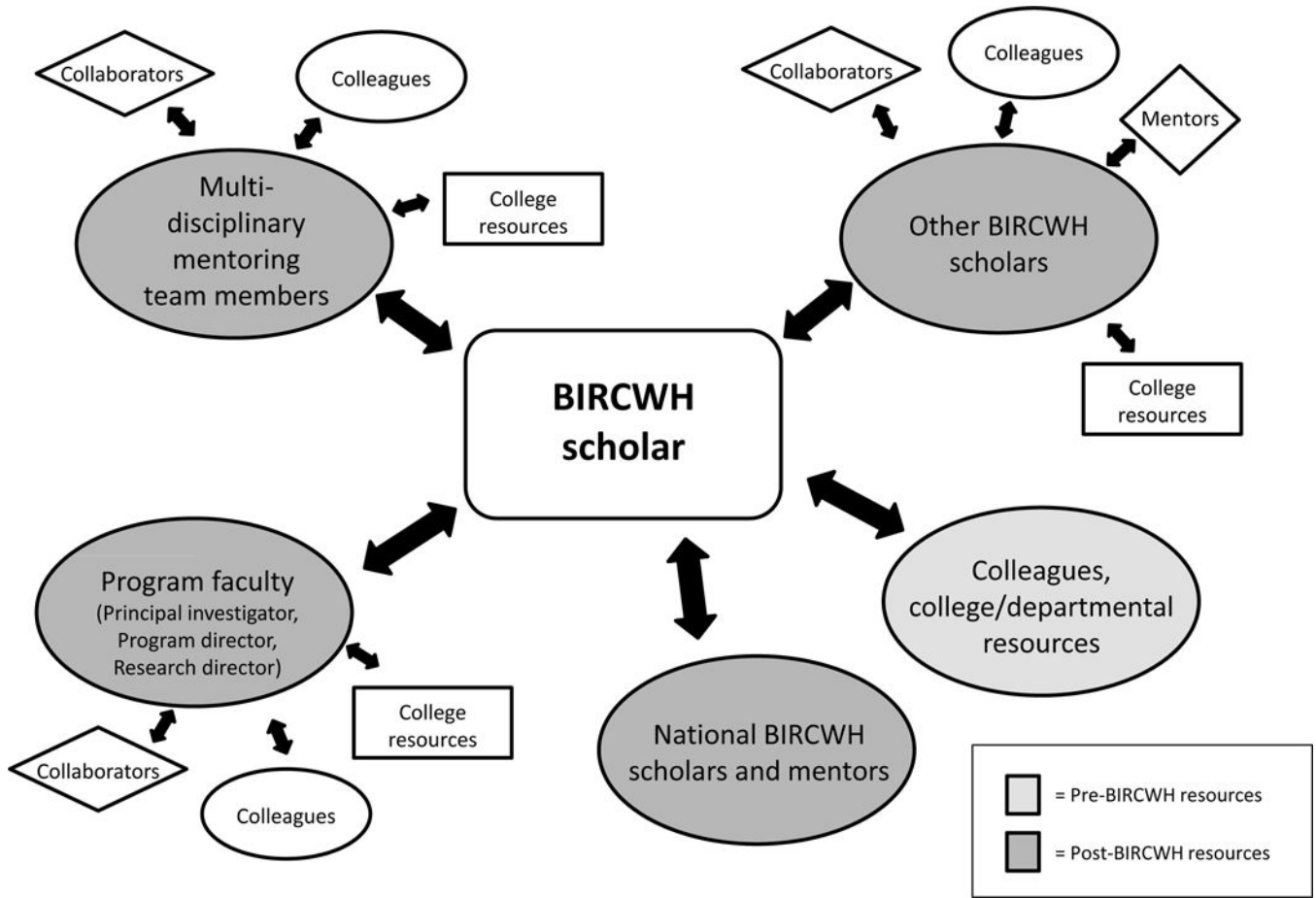


Figure 1. Model depicting how BIRCWH programs expand research networks and career opportunities for their scholars, with multiple inputs that help BIRCWH scholars optimize their time in the BIRCWH program and optimally develop their career. These inputs include the multidisciplinary mentoring team, the cohort benefits of being among other BIRCWH scholars, the national BIRCWH program faculty, scholars, mentors, and National Institutes of Health leaders to whom the scholar is exposed during the national meeting and the resources of the scholar’s institution.
Abbreviation: BIRCWH indicates Building Interdisciplinary Research Careers in Women’s Health.

Table 1

Comments from NIH K12 Program Directors and Scholars About the Effectiveness of Team Mentoring, From a Study of the Advantages and Challenges to Team Mentoring, 2014

Source of comment	Team mentoring works when... ^a	Team mentoring doesn't work when... ^a
Program directors	<ul style="list-style-type: none"> • Mentors bring multiple perspectives/expertise (strengthens study design, improves grants) • Mentors are committed to scholar (gives scholar confidence and credibility) • The scholar is proactive • Mentors work together collaboratively • Mentors promote networking activities for scholar • "When team members relay experience/expertise and assist with networking that can specifically focus on career development." • "Best interests of mentee are of primary importance to mentors." 	<ul style="list-style-type: none"> • Scholar has difficulty managing conflicting points of view/advice • Mentors are not dedicated to scholar • Scheduling is challenging • "1. Too many differing opinions if consensus is not reached by the group. 2. Scholar may get mixed messages and pulled in different directions which detract from main focus. 3. Individual mentors may have alternative agendas for scholar."
Current scholars	<ul style="list-style-type: none"> • Mentors bring multiple perspectives/expertise (strengthens study design, improves grants) • New idea are generated for projects or publications • Mentors promote networking activities for scholar • Research design and project development • The scholar can see different model or paths to achieve a successful career and prioritize successfully) • "Very helpful for publications—i.e., when to submit, which journal to submit to, how to best formulate the data—also very helpful in terms of strategies for grant applications, where to apply, when to apply—helpful for networking, as my mentors come from diverse fields." 	<ul style="list-style-type: none"> • Conflicting points of view/advice • Scheduling is challenging • No primary mentor is identified • Scholar and/or mentors are unprepared for meetings • One-on-one mentoring may be better for specific training • "The mentors typically don't interact much or have much to do with areas not related to their area of mentoring, so sometimes things can get confusing." • "Scheduling is a nightmare." • "Bystander effect (no one feels entirely responsible)."
Former scholars	<ul style="list-style-type: none"> • When mentors can gather together and listen to each other and the scholar • Career development advice from different perspectives • Mentors bring multiple perspectives/expertise (strengthens study design, improves grants) • When scholar is prepared for meetings • "Helped expand my methodological approaches. Provided another perspective on manuscripts and grants preparation." • "The diverse range of opinions I received on my research project was invaluable. Giving formal presentations on a regular basis helped strengthen my speaking skills. Participating in mentor discussions helped hone my analytical thinking skills. Without the structure of this BIRCWH training format, I likely would have been dependent only/primarily upon my PI for feedback on my research progress and career goals. The BIRCWH training provided me with additional perspectives—again, invaluable." 	<ul style="list-style-type: none"> • Managing conflicting points of view/ advice • Scheduling is challenging • Lack of communication among scholar and mentors • "Trying to satisfy senior opinions can be challenging." • "When I was not organized or did not provide my team with clear requests for assistance."

Abbreviations: NIH indicates National Institutes of Health; BIRCWH, Building Interdisciplinary Research Careers in Women's Health program; PI, primary investigator.

^aItalics indicates direct quotes from participants.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Advice from NIH K12 Program Directors, Current Scholars and Former Scholars to New Scholars Regarding Team Mentoring, From a Study of the Advantages and Challenges to Team Mentoring, 2014

Source of advice	Advice to scholars ^a
Program directors	<ul style="list-style-type: none"> • Listen to mentors and learn • Don't be intimidated • Be proactive (plan, engage mentors, run meetings) • "Do not be intimidated to put powerful people on your committee and elicit their help." • "As with all mentoring, a lot of what you get out of it is what you put into it." • "Take full advantage of it—think through what fields are most important for you to master or integrate and approach people whose work you admire in the field."
Current scholars	<ul style="list-style-type: none"> • Be proactive (drive meetings, schedule frequent meetings, be prepared) • Choose mentors wisely and ensure diversity • Look for mentors with good track records • Meet in person regularly • "The scholar needs to be proactive for all aspects of the mentoring team. The mentors will rarely come to you with advice and unless you ask." • "Pick a variety of individuals from different areas of expertise, but also people who will respect you as an individual."
Former scholars	<ul style="list-style-type: none"> • Make sure mentors understand their role • Don't worry about making everyone happy, having everything perfect for meetings, etc. • Schedule meetings far in advance • Select strong and diverse mentors • <i>"Not to worry about making everyone happy along the way; if you succeed, they are all happy."</i> • "Plan meetings well in advance, keep scheduled meetings in place even if you don't have data, etc., to review and use them for career planning, long term development, etc." • "Having multiple mentors helps prevent getting tunnel vision! It is worth the extra effort."

Abbreviation: NIH indicates National Institutes of Health.

^aItalics indicates direct quotes from participants.

Table 3

Suggested Questions from NIH K12 Program Directors, Current Scholars, and Former Scholars to Evaluate Team Mentoring, From a Study of the Advantages and Challenges to Team Mentoring, 2014

Type of question and source	Questions
Outcomes^a	<ul style="list-style-type: none"> Scholar needs and expectations versus degree to which team mentoring helped them achieve those Opportunities for networking Opportunities to attend and/or present at conferences related to the mentee's field Time to translate research into practice Career development (e.g., scholar's satisfaction, work/life balance, etc.) Number of submitted and published manuscripts Number of grants submitted, awarded Number of manuscripts developed with the scholar's mentorship team (as opposed to only one mentor)
Process^a	<ul style="list-style-type: none"> Frequency of team mentoring meetings Benefits of team mentoring Challenges of team mentoring Evaluation of make-up of mentoring team (e.g., number, discipline, personality mix, dedication to scholar) Evaluation of what scholars hoped to get from mentoring process vs. what they received from mentoring process (e.g., skills they would like to learn) Creation of clear, formalized guidelines for mentoring meetings Management of competing advice, mentoring styles, expectations, etc. Describe a few observations about team mentoring when it works/doesn't work (consider career development, research design approach, grant writing, publications, networking, etc.). List what about team mentoring had the greatest impact on the scholar's success
Individual recommendations	
Program directors	<ul style="list-style-type: none"> Describe the types of discussions that are most or least helpful Provide specific examples of the benefit accrued by team mentoring Ask scholar if he/she would seek to keep this mentoring team in place beyond the BIRCWH funding period Ask scholar if he/she would wish to recreate a different team of mentors Ask scholar about the frequency of disagreements
Current scholars	<ul style="list-style-type: none"> Describe how the team mentoring approach has impacted the scholar's goals while a BIRCWH scholar Ask scholar if he/she feels as if her mentors are adequately engaged individually and collectively in the scholar's work and development Ask scholar if the degree of mentoring which he/she receives through the team mentoring approach is sufficient for her development as a scholar Ask scholar if he/she had the option between individual mentoring and team mentoring, which he/she would choose, and why Ask scholar if he/she would have interdisciplinary team mentoring available to her without the BIRCWH program
Former scholars	<ul style="list-style-type: none"> Ask scholar if he/she feels that her mentors know his/her very well

Type of question and source	Questions
	<ul style="list-style-type: none">• Ask scholar if he/she respects the advice his/her mentors are giving• Ask scholar if all mentors in his/her mentoring team/group are aware of each other's input

Abbreviations: NIH indicates National Institutes of Health; BIRCWH, Building Interdisciplinary Research Careers in Women's Health program.

²Recommended by all three groups: program directors, current scholars, former scholars.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript