

SPNSOR: A Structured Mentorship Network Intervention to Support Postdoctoral Success

Carbajal, A., Setiono, F., Kuvaeva, A., Sancheznieto, F., Simmons, E., & Lambert, M.

State University of New York - Downstate

There is a pressing need for evidence-based, holistic mentoring programs to support STEM postdoctoral scholars in STEM and sustain biomedical innovation. Literature suggests that more effective mentorship models must move beyond traditional dyadic (one-on-one) structures focused solely on research support, to models that provide holistic guidance from a network of mentors across domains of research, career, and wellbeing. To foster this, we developed and piloted an 8-week program called SPNSOR (Structured Professional Networks for Successful Outcomes in Research). Grounded in both social network and social capital theory, SPNSOR responds to the increasing support for developmental network models, where trainees engage with multiple mentors to meet their holistic needs. Launched in January 2025, biomedical postdocs across New York State were randomized to two groups: an intervention group (n=9), which participated in weekly 1.5-hour virtual sessions over 8 weeks covering topics such as goal setting, assessing mentoring gaps, building new relationships, and navigating conflicts, or a control group (n=10), which received a single 2-hour workshop focused on optimizing their primary mentoring relationship. Initial results demonstrate high satisfaction, acceptability, and utility of the intervention (median score of 4.5/5). A focus group at 3 months will assess the perceived appropriateness of program length and format. Interviews with faculty and academic leaders will explore the feasibility of integrating SPNSOR into formal postdoctoral training programs. These early findings suggest that SPNSOR is a relevant, feasible and well-received intervention that addresses critical gaps in postdoctoral mentorship by fostering strategic, network-based support.

Keywords: Mentor network, postdoctoral scholars, STEMM, career outcomes, mentoring programs

Acknowledgements: Research was supported by the National Institute of General Medical Sciences of the NIH under award number R35GM151017. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Introduction

Postdoctoral scholars (postdocs) are a vital, yet frequently overlooked, segment of the scientific workforce with about 75,000 in the U.S. alone (Jach, 2024). Postdocs pursue research and advanced training, and while also contributing to teaching, the mentorship of junior trainees (undergraduate and graduate students, technicians, etc.), and service activities. Despite their utmost importance, the postdoc experience is often characterized by inconsistent or unclear programmatic expectations, limited institutional support, and high levels of financial, emotional, and professional stress (Alunde et al., 2020; Gangrade & Lambert, 2023; Tuma et al., 2021).

Additionally, unlike undergraduate or graduate students, postdocs are rarely supported with formal mentorship structures, and mentorship is mostly dyadic (one-on-one) in nature. However, studies have elucidated that having multiple

mentors can alleviate challenges and restrictions which often arise when a mentee is relying on solely one mentor, particularly during the often ambiguous and under-supported postdoc phase (Gangrade, 2024, Gangrade & Lambert 2023). Given the growing challenges postdocs face today, a mentorship network can offer the critical, holistic support postdocs need to succeed (Gangrade & Lambert, 2023). Effective, holistic mentorship encompassing psychosocial support, career development, and science identity-affirming relationships, has been shown to significantly influence retention and success in science, technology, engineering, mathematics and medicine (STEMM) (Gangrade & Lambert, 2023; Haggard et al., 2011, Montgomery et al., 2017).

To address persistent mentorship gaps faced by biomedical postdocs in the U.S., the Structured Professional Network for Successful Outcomes in Research (SPNSOR) program, an innovative, mentor network intervention, was developed.

Building on previous research identifying mentoring challenges among postdoctoral training (e.g., Lambert et al., 2023; Gangrade & Lambert, 2023), SPNSOR aims to train biomedical science postdocs on how to cultivate a mentorship network that can effectively help them to achieve their research, career, and personal goals. The program also explicitly encourages connections across different types of mentoring roles including sponsors, identity-affirming mentors, connectors, peer mentors, etc., and provides useful tools to mitigate challenges posed by insufficient and/or negative mentoring relationships. The aim of this study was to assess the feasibility, acceptability, and value of SPNSOR to postdocs, piloted between January - March 2025.

Literature Review

Postdocs are a critical segment of the STEM/biomedical research workforce. Effective mentorship is fundamental for retaining postdocs and their successful transition to faculty and non-faculty careers (Yadav et al., 2020). However, postdocs often lack structured, intentional mentorship; likely due to increased expectations for postdocs' independence compared to undergraduate and graduate students, as well as the absence of training and accountability for faculty mentors (Alunde et al., 2020). Holistic mentorship, which includes career development and psychosocial support, has been shown to increase retention and success in STEM (Gangrade & Lambert, 2023; Montgomery et al., 2017). Positive mentorship correlates with key milestones, such as, publishing, securing grants, and transitioning to faculty positions (Lambert et al., 2023). Conversely, negative mentoring, such as neglect or misalignment, may result in lack of progress, isolation, and attrition from science (Tuma et al., 2021).

In the U.S., numerous mentorship and professional development programs have been established to support graduate students and some postdocs, mostly US citizens, who must further meet other qualifications. Despite an attempted increase to create programs for trainees, there remains still a significant deficit due to existing only at a few universities, quality and length of programming, and postdocs exclusion. For those pursuing academia, the Preparing Future Faculty (PFF) program, sponsored by the Council of Graduate Schools, exists in about 300 institutions, offering some mentorship and faculty prep (Eisen & Eaton, 2018; Sancheznieto et al., 2021). Additionally, the National Institutes of Health (NIH) has historically funded comprehensive programs but excludes 57.9% of postdocs who lack citizenship (Smith et al., 2024). These NIH supported programs included the Initiative to Maximize Student Development (IMSD) for graduate students, and the IRACDA and BETTR programs for postdocs, that integrate research with teaching at partner institutions.

Typically, these programs recruited those excellent in research and interested in cultivating

other aspects of faculty roles like service and teaching. Underrepresented trainees are well accounted for in these programs, unlike the greater pool of STEM postdocs. These initiatives emphasized mentorship, community building, and career development to support their scientific and pedagogical advancement, but due to NIH cuts in 2025, these programs no longer exist. However, NIH T32, K, and F awards remain active, and require applicants to secure mentorship and submit support letters, reinforcing acquiring mentorship for postdoctoral training (Eisen & Eaton, 2018; Sancheznieto et al., 2021).

The Postdoc Academy, an asynchronous online course piloted five times between 2020 and 2022 by the National Association of Postdocs, enrolled 473 postdocs to test the utility of this intervention through taking the course and filling out a comprehensive needs assessment survey (Sun et al., 2023). Participants cited mentor support as the most critical factor for success, while lack of time and inadequate mentorship were top barriers. Though the course underscored the importance of effective mentorship, it lacked guidance on building mentor networks, leveraging multiple mentors, or navigating negative mentor relationships (Sun et al., 2023). Despite these efforts, substantial challenges remain. The IMSD and IRACDA programs have been discontinued, and eligibility for T32, K, and F awards has become more restrictive. While frameworks like "Mentoring Up" empower trainees to better communicate their needs, and courses like the Postdoc Academy aim to enhance training, gaps in support for postdocs persist. A 2018 U.S. survey by Grinstein and Treister revealed a primary factor contributing to postdoc dissatisfaction: the daily lab environment. Only 28.4% of postdocs would recommend a postdoc to others, highlighting how current programs are failing to address critical aspects of the daily postdoc experience. Similarly, a 2024 study by Jach described widespread feelings of postdoc isolation, who often lack the cohort-type support from graduate school. International scholars, who comprise a large population of the U.S. postdocs, face additional barriers, as many programs are inaccessible, contributing to a shrinking international postdoc population.

To overcome other program limitations, including sweeping cuts in 2025 to supportive programs, we developed SPNSOR, a randomized-controlled program designed to help early career postdocs regardless of citizenship status, build diverse mentorship networks through eight tailored 1.5-hour synchronous lessons. Unlike traditional one-on-one mentoring, SPNSOR encourages cultivating a broader support system encompassing technical, career, and psychosocial mentors, including those who share personal identities (Figure 1) (Gangrade & Lambert, 2023). This approach reflects a shift toward more holistic, evidence-based models of mentorship. This model acknowledges that a single mentor cannot meet all needs and emphasizes expanding support through technical, career, and psychosocial mentors, including those with shared

identities (Gangrade & Lambert, 2023). Focus on mentorship networks was informed by several theoretical frameworks. One is the social capital theory, which posits that resources and capital are accessible in one’s social network (Coleman, 1988, Nahapiet & Goshel, 1998). Based on this theory, it has been suggested that varying types of mentoring relationships provide unique capital that overall promotes researchers’ success (Aiken et al. 2016).

Another is social network theory that asserts social relationships influence and transfer information (Dunn, 1983). The efficiency of this

process is dependent on components of the network (i.e., number, importance, and strength of connections) (Higgins & Kram, 2001). The development of SPNSOR was also based on lessons and strategies on mentoring competencies from other successful interventions, such as “Mentor Training for Clinical and Translational Researchers” by Pfund et al. (2014) and “Mentoring Up” by Sancheznieto et al. (2024). If proven effective and scalable, SPNSOR has potential to improve postdoc experiences and retention, while fostering a more inclusive, resilient, and innovative scientific workforce.

Figure 1.
Traditional mentoring framework alongside novel mentor network description

	ONE ON ONE MENTORSHIP	MENTORSHIP CONCEPTS IN SPNSOR
Number of individuals involved	One mentor - one mentee	One mentee has several mentors in a network/group
Where mentors are found	Within the organization	Within and/or outside the organization
Mentor roles	Mentors typically play the role of a research mentor	One can find mentors with distinctive roles e.g., coach, connectors, role model, etc.
How mentors are viewed	Expert passing on knowledge	Co-learners sharing knowledge

Methods

Intervention

The overall structure of SPNSOR is composed of three main parts, grounded in empirical evidence across mentorship studies: 1) Defining mentorship and individuals’ needs, 2) finding mentors (existing and potential) and establishing mentorship relationship (Higgins & Kram, 2001; Montgomery,

2017), and 3) maintaining one’s network for effective mentorship (Gangrade & Lambert, 2023; Montgomery, 2017). These three components are explored through facilitator-guided discussion, case studies and practical exercises across eight 1.5 hour lessons. Lesson title and description of each lesson can be found in Figure 2. All lessons were hosted online, except the first session which was in person.

Figure 2.
SPNSOR program’s topics and lesson’s titles

 I. DEFINING MENTORSHIP AND IDENTIFYING NEEDS	Lesson 1	Introduction to Effective Mentorship: Mentoring Up
	Lesson 2	Goal Setting
 II. FINDING MENTORS AND ESTABLISHING MENTORSHIP RELATIONSHIPS	Lesson 3	Mentor and Resource mapping
	Lesson 4	Finding and Establishing Mentorship
 III. MAINTAINING NETWORK FOR EFFECTIVE MENTORSHIP	Lesson 5	Maintaining your Mentor Network and Wellness
	Lesson 6	Negotiating within your Mentoring Relationships
	Lesson 7	Conflict Resolution
	Lesson 8	Moving Ahead in your Mentoring Journey

Outcome Measures

Several implementation science measures evaluating SPNSOR's usability/utility (3 items), ease of adoption (3 items), acceptability (7 items), appropriateness (6 items), and feasibility (3 items) were asked. Each was scored on a 5-point Likert scale, where 1 is "strongly disagree" and 5 is "strongly agree". Additional questions on appropriateness and perceived value of SPNSOR's lessons and format were also added. These data were collected post-program through an online survey using REDCap.

Participant Recruitment

A list of institutions in New York State (NYS) with research funding were collected from the 2023 Higher Education Research and Development Survey by the National Center for Science and Engineering Statistics (National Science Foundation, 2024). A list of medical institutions in NYS was also obtained from the Association of American Medical Colleges (AAMC, 2025). For each institution, names and contacts for postdoctoral offices or associations, and designated institutional officials were collected through a web search. These individuals were asked to share SPNSOR recruitment flyers with postdocs at their institutions. The email contained information about the program, expected research activities, and a link to the eligibility screening survey. To be eligible, the individual must be an

early-career postdoctoral scholar (0-1 year) in biomedical sciences. All interested and eligible participants were randomized using a random number generator to the intervention and control group. For the pilot, 9 consented to the intervention group and 10 in the control group.

Data Analysis

Collected data was cleaned. Descriptive statistics were calculated; median and ranges were reported for items scored on a Likert scale, whereas counts and proportions were tabulated for categorical variables. Analysis was done using Python v 3.13.2.

Human Subject Approval

All research activities were reviewed and approved by SUNY Downstate Health and Sciences Institutional Review Board & Privacy Board IRB#1981725.

Results

All participants receiving the SPNSOR program started their postdoc late 2023 or 2024 in a NYS-based institution and were in biomedical sciences ranging immunology, molecular biology, neuroscience, and others. Demographic characteristics of participants are described in Table 1.

Table 1.

Demographic characteristics of SPNSOR study participants by study arm (n=19)

Characteristics	SPNSOR (n=9)		Control (n=10)	
	n	%	n	%
Gender				
Female	7	77.7	8	80.0
Male	2	22.2	2	20.0
Ethnicity				
Hispanic/Latin/Spanish origin	3	33.3	1	10.0
Not Hispanic/Latin/Spanish origin	6	66.6	9	90.0
Race ^a				
Asian/Asian American	2	22.2	1	10.0
Black/African American	2	22.2	1	10.0
White/European American	3	33.3	3	30.0
Other	2	22.2	5	50.0
First generation graduate ^b	6	66.6	6	60.0
Individual from disadvantaged background ^b	5	55.5	5	50.0

^aIndividuals may be counted multiple times if having more than one race.

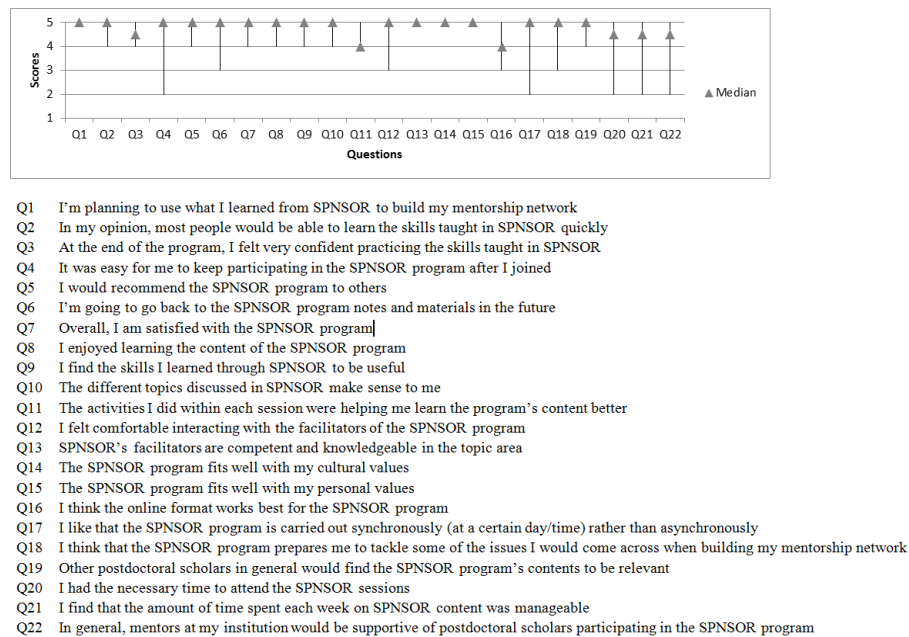
^bReflects the number and percentage of participants answering "yes" to this question.

Overall, participants rated SPNSOR to be a beneficial, acceptable, and appropriate program they would recommend to others (see Table 2.) Median scores for all implementation measures were ≥ 4.0 out of a possible score of 5.0. The range of these

scores were mostly narrow, with the largest (range of 2.0 - 5.0) coming from questions on whether participants felt they had sufficient time to continue in SPNSOR. However, median scores for these questions remained high (4.5).

Figure 3.

Median and ranges of participants' responses to implementation science measures evaluating the SPNSOR Program (n=8)^a. Scores range from 1 - 5, with 1 being "strongly disagree",



and 5 being "strongly agree"^aOne individual did not complete the post-program survey. Thus, the final n=8.

In addition to these, participants rated SPNSOR's lesson length (1.5 hours) and total program length (8 lessons) as "too long", "too short", or "just right". All (100%) said 1.5 hours per lesson was "just right". The majority (62.5%) said 8 lessons were "just right", with 37.5% reporting it was "too long", and 12.5% stating it was "too short". In terms of most useful, the top lessons (earning 5 out of 8 votes each) were the first two: "Introduction to Effective Mentorship: Mentoring Up" and "Goal Setting".

Discussion

The goal of this study was to test the feasibility, utility and relevance of an intervention that helps postdoctoral researchers build effective mentoring networks to aid their success. Our preliminary findings of SPNSOR suggest this intervention model is feasible and relevant to early-career biomedical postdocs in New York state. Participants reported a high level of satisfaction, with all implementation measures receiving a median score of 4.0 or higher out of 5.0. Even for items with neutral or slightly negative ratings, such as whether participants had sufficient time to engage with the program, the median remained high at 4.5. This suggests that participants felt participating in SPNSOR was useful and feasible in its current format, even amid the often-intense schedules of these postdocs. Notably, the lessons rated as most useful, "Introduction to Effective

Mentorship: Mentoring Up" and "Goal Setting", inspired by mentoring studies and frameworks (Newby & Heide, 1992) suggest key developmental needs among postdocs. Participants largely agreed that SPNSOR also prepared them to tackle issues that may arise when building a mentorship network. While these points deserve further evaluation in the next iteration, our results are indicative of SPNSOR's contribution to their sense of agency, pivotal for developing mentoring relationships and maintaining these relationships (Griffin et al., 2018). These early sessions focus on empowering postdocs to proactively navigate their mentoring relationships and clarify their career trajectories. This aligns with existing data emphasizing the importance of mentorship quality and self-directed career planning in improving postdoc satisfaction and retention, including underrepresented groups in STEM (e.g., Pfund et al., 2016; Williams et al., 2020). The popularity of these topics suggests training gaps around mentorship dynamics and long-term career planning; areas postdocs often lack structured guidance. Participants also provided uniformly positive feedback on the structure of SPNSOR. All (100%) agreed the 1.5-hour lesson duration was "just right," and most (62.5%) indicated the total length of eight sessions was appropriate. Our data support the structure of SPNSOR and suggest the time commitment is doable and well-calibrated for the postdoc experience.

Our findings are promising, yet there were some limitations. First, the data reflects nine individuals and their views, all based in NYS, which limits the generalizability of the results. Future phases of this study will include larger control and intervention groups to allow for more robust analyses. Participants may have had a predisposed interest in the program's subject matter, potentially skewing results toward more favorable responses. However, survey results will be further explored through a focus group with SPNSOR participants, to provide more nuanced insights into participant experiences for future iterations. A future study will expand on the feasibility of incorporating SPNSOR into formalized postdocs training in institutions through focus groups with faculty and administrative staff. The second iteration of SPNSOR is planned and will include postdocs from other states. Expanding and increasing the participant pool will also help account for differences in institutional culture, disciplinary focus, and mentoring practices that influence program effectiveness.

Conclusion

Our findings offer theoretical and practical implications for improving the landscape for all postdocs. We conclude that SPNSOR, an evidence-based mentor network focused program, is highly acceptable and needed program for early-career postdocs. Theoretically, it reinforces the value of holistic mentorship training for postdocs, especially in domains that address autonomy and long-term goal setting. Practically, the findings suggest programs like can be feasibly integrated into postdoctoral training without overburdening trainees while delivering substantial benefit. SPNSOR results suggest it could meet a key developmental need among postdocs by cultivating effective mentorship network skills and goal-setting strategies. Though further research is required, initial data support SPNSOR as a promising model for strengthening training and increasing retention within the biomedical workforce.

References

- AAMC. (2025). AAMC Institutions in New York. <https://whatstartshere.aamc.org/states/new-york>
- Aikens, M. L., Sadselia, S., Watkins, K., Evans, M., Eby, L. T., & Dolan, E. L. (2016). A social capital perspective on the mentoring of undergraduate life science researchers: An empirical study of undergraduate-postgraduate-faculty triads. *CBE—Life Sciences Education*, 15(2), ar16. <https://doi.org/10.1187/cbe.15-10-0208>
- Ålund, M., Emery, N., Jarrett, B. J., MacLeod, K. J., McCreery, H. F., Mamoozadeh, N., Phillips, J. G., Schossau, J., Thompson, A. W., Warwick, A. R., Yule, K. M., Zylstra, E. R., & Gering, E. (2020). Academic ecosystems must evolve to support a sustainable postdoc workforce. *Nature Ecology & Evolution*, 4(6), 777–781. <https://doi.org/10.1038/s41559-020-1178-6>
- Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94(1), S95–S120. <http://www.jstor.org/stable/2780243>
- Dunn, W. N. (1983). Social network theory. *Knowledge*, 4(3), 453–461. <https://doi.org/10.1177/107554708300400306>
- Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *The Academy of Management Review*, 23(2), 242–266. <https://doi.org/10.2307/259373>
- Gangrade, N., Samuels, C., Attar, H., Schultz, A., Nana, N., Ye, E., & Lambert, W. M. (2024). Mentorship interventions in postgraduate medical and stem settings: A scoping review. *CBE—Life Sciences Education*, 23(3), ar33–ar33. doi: 10.1187/cbe.23-08-0155
- Gangrade, N., & Lambert, W. M. (2023). Postdoctoral mentorship needs a reform. *Trends in Molecular Medicine*, 30(1), 6–9. <https://doi.org/10.1016/j.molmed.2023.10.002>
- Griffin, K., Baker, V., O'Meara, K., Nyunt, G., Robinson, T., & Staples, C. (2018). Supporting scientists from underrepresented minority backgrounds: Mapping developmental networks. *Studies in Graduate and Postdoctoral Education*, 9(1), 19–37. 10.1108/SGPE-D-17-00032.
- Grinstein, A., & Treister, R. (2018). The unhappy postdoc: A survey based study. *F1000Research*, 6, 1642. <https://doi.org/10.12688/f1000research.12538.2>
- Haggard, D. L., Dougherty, T. W., Turban, D. B., & Wilbanks, J. E. (2010). Who is a mentor? A review of evolving definitions and implications for research. *Journal of Management*, 37(1), 280–304. <https://doi.org/10.1177/0149206310386227>
- Jach, E. A. (2024). “I don't want to spend the rest of my life feeling alone”: Postdoctoral scholars' experiences of (dis)connection. *Education Sciences*, 14(4), 382. <https://doi.org/10.3390/educsci14040382>
- Lambert, W. M., Nana, N., Afonja, S., Saeed, A., Amado, A. C., & Golightly, L. M. (2023). Addressing structural mentoring barriers in postdoctoral training: A qualitative study. *Studies in Graduate and Postdoctoral Education*, 16(1), 1–24. <https://doi.org/10.1101/2022.08.20.504665>
- Law, D. D., Domínguez, N., Garvey, B., Hager, M. J., Hales, K., Murrell, A. J., Onosu, G. O., Arocho, R., Johnson, B. A., Legler, N., Taylor, J. Y., Dart, G., Christiansen, M. A., Busen-

- bark, D., Fain, L. Z., Crites, J., Hernandez, P., Mickel, N., Clabaugh, D., & Assata Zerai. (2023). *Making connections: A handbook for effective formal mentoring programs in academia*. DigitalCommons@USU. <https://doi.org/10.26079/ff55-d7a0>
- Montgomery, B., & Page, S. (n.d.). Mentoring beyond hierarchies: Multi-mentor systems and models. <https://nap.nationalacademies.org/resource/25568/Montgomery%20and%20Page%20-%20Mentoring.pdf>
- Montgomery, B. L. (2017). Mapping a mentoring roadmap and developing a supportive network for strategic career advancement. *SAGE Open*, 7(2), 2158244017710288. <https://doi.org/10.1177/2158244017710288>
- National Postdoc Association (n.d.). <https://www.nationalpostdoc.org/>
- National Science Foundation. National Center of Science and Engineering Statistics. (2024). Higher education research and development (HERD) survey 2023. <https://nces.nsf.gov/surveys/higher-education-research-development/2023>
- Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *The Academy of Management Review*, 23(2), 242–266.
- Newby, T. J., & Heide, A. (2008). The value of mentoring. *Performance Improvement Quarterly*, 5(4), 2–15. <https://doi.org/10.1111/j.1937-8327.1992.tb00562.x>
- Nieminen, J. H., & Ruttenberg-Rozen, R. (2024). In search of a community: navigating the academic spaces of belonging as a postdoctoral fellow. In M. Aarnikoivu & A. T. Le (Eds.), *Building communities in academia* (pp. 43–58). Emerald Publishing Limited. <https://doi.org/10.1108/978-1-83797-500-620241004>
- Nowell, L., Ovie, G., Kenny, N., & Jacobsen, M. (2020). Postdoctoral scholars' perspectives about professional learning and development: A concurrent mixed-methods study. *Palgrave Communications*, 6(95). <https://www.nature.com/articles/s41599-020-0469-5>
- Orsini, J., Hyun, S. H., & Sancheznieto, F. (2024). Mentoring up: How mentorship training influences mentee intent to change behavior. *Journal of Clinical and Translational Science*, 8(1). <https://doi.org/10.1017/cts.2024.589>
- Pfund, C., House, S. C., Asquith, P., Fleming, M. F., Buhr, K. A., Burnham, E. L., Eichenberger Gilmore, J. M., Huskins, W. C., McGee, R., Schurr, K., Shapiro, E. D., Spencer, K. C., & Sorkness, C. A. (2014). Training mentors of clinical and translational research scholars: A randomized controlled trial. *Academic Medicine*, 89(5), 774–782. <https://doi.org/10.1097/ACM.0000000000000218>
- Sancheznieto, F., Asquith, P., Baez Bermejo, A., Meagher, E. A., & Pfund, C. E. (2024). Mentoring Up for early career investigators: Empowering mentees to proactively engage in their mentoring relationships. *Journal of Clinical and Translational Science*, 8(1), e86. <https://doi.org/10.1017/cts.2024.524>
- Sancheznieto, F., Sorkness, C. A., Attia, J., Buettner, K., Edelman, D., Hobbs, S., McIntosh, S., McManus, L. M., Sandberg, K., Schnaper, H. W., Scholl, L., Umans, J. G., Weavers, K., Windebank, A., & McCormack, W. T. (2021). Clinical and translational science award T32/TL1 training programs: Program goals and mentorship practices. *Journal of Clinical and Translational Science*, 6(1). <https://doi.org/10.1017/cts.2021.884>
- Smith, B., Arbeit, C. A., Thompson, H., Yamaner, M.I.; National Center for Science and Engineering Statistics (NCSES). (2024). *Graduate enrollment and postdoctoral appointments in science, engineering, and health rise, driven largely by increases in the number of women and temporary visa holders*. NSF 25-316. Alexandria, VA: U.S. National Science Foundation. Available at <https://nces.nsf.gov/pubs/nsf25316>.
- Sun, T., Drane, D., McGee, R., Campa, H., Goldberg, B. B., & Hokanson, S. C. (2023). A national professional development program fills mentoring gaps for postdoctoral researchers. *PLOS ONE*, 18(6). <https://doi.org/10.1371/journal.pone.0275767>
- Tuma, T. T., Adams, J. D., Hultquist, B. C., & Dolan, E. L. (2021). The dark side of development: A systems characterization of the negative mentoring experiences of doctoral students. *CBE—Life Sciences Education*, 20(2), ar16. <https://doi.org/10.1187/cbe.20-10-0231>
- Weber-Main, A. M., Engler, J., McGee, R., Egger, M. J., Jones, H. P., Wood, C. V., Boman, K., Wu, J., Langi, A. K., & Okuyemi, K. S. (2022). Variations of a group coaching intervention to support early-career biomedical researchers in grant proposal development: A pragmatic, four-arm, group-randomized trial. *BMC Medical Education*, 22(1). <https://doi.org/10.1186/s12909-021-03093-w>
- Yadav, A., Seals, C. D., Sullivan, C. M. S., Lachney, M., Clark, Q., Dixon, K. G., & Smith, M. J. T. (2020). The Forgotten scholar: Underrepresented minority postdoc experiences in STEM fields. *Educational Studies*, 56(2), 160–185. <https://doi.org/10.1080/00131946.2019.1702552>