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# "I Don't Want to Spend the Rest of My Life Feeling Alone": Postdoctoral Scholars' Experiences of (Dis)Connection

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**Abstract:** Previous research about postdocs has focused on the challenges they face in terms of pay and job security. This study expands upon this narrative to explore postdoctoral scholars' experiences of connection and disconnection, or (dis)connection. The present study employed socialization theory in combination with a definition of professional socialization to frame how personal communities, institutions, and professional disciplines/associations facilitated postdocs' sense of (dis)connection. Interviews with 30 postdocs demonstrated the ways in which postdocs described both connection and support alongside disconnection and isolation when asked about their experiences. The present study extends theory on socialization to consider postdocs and has implications for institutions employing postdocs.

**Keywords:** postdoctoral scholars; early career socialization; professional socialization

## 1. Introduction

The U.S. National Postdoctoral Association defined postdoctoral scholars (or postdocs) as "individuals who hold doctoral degrees and who are engaged in a temporary period of mentored research and/or scholarly training for the purpose of acquiring the professional skills needed to pursue their chosen career path" [1] (para. 1). While postdoc positions have occurred more frequently in fields such as Science, Technology, Engineering, and Mathematics (STEM), as well as in health [2], they have also become more prevalent in fields such as psychology and other social sciences [3]. Although the postdoc position has been liminal in status by design, postdocs have been critical to the research enterprise in terms of research productivity [4] and graduate student training [5,6]. Therefore, understanding their experiences matters for informing better practices for fostering situations that facilitate postdocs' success.

The present study considered qualitative interviews with 30 postdoctoral scholars working in the United States to examine the following research question: how do postdocs experience connection? With a focus on postdocs' experiences through a socialization theory [7] and professional socialization [8] lens, the findings illuminated challenges and opportunities for improvement so that postdocs can feel more connected toward improved well-being and greater contributions to institutional research goals.

### 1.1. Relevant Literature

I examine the research about postdoctoral scholars' experiences broadly and then introduce the literature about early career professional socialization. By exploring these bodies of literature, I provide a context for the current investigation about postdoctoral scholars and their experiences of (dis)connection.

#### 1.1.1. Postdoctoral Scholars

While researchers have critiqued the fact that there is not a definitive source of demographic data about postdoctoral scholars [3], several sources have illuminated who

has constituted this population. The National Postdoc Association has published a report indicating that there are more than 70,000 postdocs employed in the United States [9]. In a survey that sought representative data from postdoc employers across the United States, approximately half of postdocs were men and half were women [3]. This same analysis also found approximately half of postdocs had U.S. citizenship and half were internationals working in the United States on a visa, with a growing number of postdocs in non-STEM fields such as the social sciences. Over the past several decades, postdocs have been increasingly employed as a means of affordable personnel for high levels of research productivity [10,11]. *PLoS ONE* reported an increase in the number of students considering graduate education and postdoctoral training in the field of biomedicine over the past seven decades [12]. However, recent government data has suggested a decline in international postdocs and an increase in the number of domestic postdocs, amidst a decline in postdoc employment overall [2]. Notably, U.S. government data has focused on fields within the broader disciplines of science, health, and engineering [2,13].

Postdocs have been subjected to a variety of concerning issues, such as discrimination, sexual harassment, and job insecurity [14]. Reports of postdocs being bullied have made news headlines [15]. Furthermore, researchers have found evidence for negative mental health symptoms contributing to postdocs' lowered job satisfaction, demonstrating a need to ensure that employers engage in support strategies to buoy mental health [16]. Critics have called for educational leaders to engage in social justice advocacy for postdoctoral scholars, given their susceptibility to marginalization [17]. Compensation has been a highly rated concern among postdocs: in a 2023 survey conducted by the National Postdoc Association, nearly 95% of respondents indicated salary has a negative impact on their work experience, and nearly 85% indicated benefits as having a negative impact [9]. Another concern has been the inconsistency in postdoc job titles [18]. It is not uncommon for individuals to spend multiple years in multiple postdocs, extending their early career trajectory. The U.S. National Institutes of Health recently released a report recommending raising the minimum salary for postdocs from $56,484 to $70,000 and capping the length of postdoc positions to 5 years [19]. Such recommendations further substantiate the need for systemic change across postdoc employment.

Both the United States National Academies and the International Organization for Economic Cooperation and Development deemed postdoctoral scholars to be part of the "research precariat" [20]. This is due to the reality that postdocs have minimal job security, low compensation, and "an unclear path to a permanent post" [20] (p. 505). The precarity of postdoc job prospects is not new [21], with the term "postdocalpyse" used to describe the number of individuals prepared for academic jobs compared to the paucity of such positions available [22]. The lack of tenure-track jobs has also been a stark reality for postdocs. In a study that examined career placement among postdoctoral scholars, researchers found that only 17% of postdocs obtained a tenure-track position [10]. And those in the field of biomedicine who worked in a postdoc position after completing a terminal degree earned nearly $250,000 less in the first 15 years after their doctorate when compared to those who entered industry [23]. Furthermore, the COVID-19 pandemic has had negative ramifications for postdocs in terms of their training experience [24–27]. These studies delineate important questions for the postdoc for the individual: is it worth it?

### 1.1.2. Professional Socialization

Despite these ongoing challenges, advocacy by and for postdocs continues to grow. In the United States, the NPA has been a leading organization in tracking progress on the status of postdocs. Their national survey of postdoc support offices found modest improvements have been made in terms of more institutions offering centralized support, but there is room to further ameliorate conditions for more consistent, high-quality experiences [9,28]. Specifically, the NPA report [9] suggested that institutions should ensure that there is standardized onboarding, minimum compensation standards, equal benefits regardless

of funding status/source, professional training opportunities, and efforts to reduce the gender disparity in postdoctoral scholarship appointments.

Research considering the experiences of postdocs has also examined the ways in which professional socialization can contribute to postdocs' meaningful development. Such efforts highlight evidence that has proven to offer positive pathways toward socialization within postdocs' academic disciplines. For example, postdocs' participation in a formal training program has been shown to increase scores on a variety of skills deemed necessary by employers and faculty members [29]. In addition to the recommendations posed by the NPA's report [9], research has suggested that learning initiatives that can benefit postdocs include areas such as: teaching and learning; mentorship; academic careers; academic writing; industry careers; networking; career planning; project management; time management; communication; leadership; and balancing work–life demands [30]. These efforts to improve postdoc infrastructure [28,31] and professional development [27,30,32] demonstrate pathways to prevent postdoc invisibility [33]. Since postdocs have proven indispensable to the research enterprise in terms of research productivity [4] and graduate student training [5,6], a more thorough examination of their experiences with socialization warrants investigation.

*1.2. Theoretical Framing*

This study uses research on early career socialization [7] and professional socialization [7] to inform the present analysis. While these may appear to be two distinct theoretical approaches, I considered both to extend these theoretical lenses to include postdoctoral scholars. Broadly, Weidman and DeAngelo [7] expanded socialization theory, originally describing the undergraduate experience, to consider early-career professionals. The model included individual factors (i.e., individual demographics and relationships within personal communities), institutional factors (i.e., campus climate, department organization), and professional/disciplinary communities (i.e., professional associations, discipline expectations and norms). While prior work on conceptualizing graduate and professional student socialization also included individual, institutional, and professional factors, some components do not fit the postdoc experience, such as the prospective student experience and the academic program experience [34]. The early career socialization approach from Weidman and DeAngelo [7] provided a more appropriate conceptualization for the experiences of postdocs. To be sure, socialization has proven to be complex to measure [35] because standardized quantitative instruments may not fully capture "the complex nature of the interactions between institution, discipline, and individual" [35] (p. 302). Therefore, qualitative approaches offer a means to understand these overlapping interactions [35] and justify the approach of the present study. While postdocs bring unique identities and experiences to their position, their career trajectory has yet to be determined and can be influenced by the postdoc experience itself within the context of the employing institution and broader professional communities.

In addition, Shahr et al.'s [8] analytical definition of professional socialization provided a broader lens regarding how individuals become members of a given profession. Their analysis of 780 articles (and a focus on a subset of 21) yielded a definition of professional socialization as "a nonlinear, continuous, interactive, transformative, personal, psychosocial and self-reinforcing process that is formed through internalization of the specific culture of a professional community, and can be affected by individual, organizational and interactional factors" [8] (p. 1). The authors further argued that engagement in a community of practice can yield individual outcomes related to professional identity and professional development [8]. A community of practice can be defined as a group of people with a shared interest who develop their expertise through routine interaction [36]. The present study employed Weidman and DeAngelo's [7] model of socialization in combination with Shahr et al.'s [8] definition of professional socialization to examine how personal communities, institutions, and professional disciplines/associations contributed to postdocs' experiences.

## 2. Materials and Methods

This study used a narrative approach as described by Merriam and Tisdell [37] to consider postdocs' experiences with connection. A narrative approach examines the stories of lived experience through consideration of psychological factors (such as social identities) and environmental factors (such as employment structures) [37]. I used a structured interview approach to compare data across individuals and settings [38]. While this structured approach does limit contextual understanding, I sought to focus on the topic of postdocs' sense of connection broadly, with attention to what consistencies may occur across the experience of postdoc employment, as opposed to using a case study to examine a single site or region [38].

### 2.1. Procedures

After obtaining approval from my employer's institutional review board, I recruited participants by sending out a paid advertisement to the National Postdoc Association's (NPA) membership listserv. Participation eligibility requirements included current full-time employment as a postdoctoral scholar and an earned terminal degree (PhD, MD). The recruitment email contained a link to an online Qualtrics survey that screened for eligibility. Interest overwhelmed me, with over 400 individuals demonstrating eligibility via the survey.

Individuals received a follow-up email inviting them to sign up for an interview using the scheduling tool Calendly. Due to limited staffing and funding, I was only able to offer 30 individual, one-hour interviews. Interviews occurred in October–November 2022. Participants signed up on a first-come, first-served basis. The sample of participants was solely based on the scheduling availabilities of participants, and I received dozens of requests for an interview beyond the available capacity. This vast interest suggests postdocs have something to say about their experience to someone who will listen.

Upon obtaining participant permission, each interview was recorded. Interviews ranged from approximately 25–75 min. Recorded interviews were securely transferred to a secure third-party transcription service for transcription. Participants received a $60 Amazon gift card via email for participating in an interview.

### 2.2. Participants

Thirty postdoctoral scholars participated in an interview, including 12 U.S. citizens and 18 non-U.S. citizens. A total of 21 participants identified as women and 9 as men; no participants identified as trans. Geographically, postdocs reported working at institutions located in the Midwest (6), Northeast (11), South (10), and West (3) regions of the United States. Disciplinary foci included four broad areas: engineering (3); the natural sciences (7); the health sciences (11); and the social sciences (9). There were no participants in the arts or humanities.

Participants were largely employed at high-research activity institutions of higher education (22), with several working directly at federal agencies or with a federal contractor (6). Two participants were employed at a university focused equally on research and teaching. All participants were assigned pseudonyms.

### 2.3. Data Analysis and Trustworthiness

To enhance the trustworthiness of the transcripts, participants were sent a copy of their transcript so that they could review it. Participants were able to request to remove anything they did not want included in the analysis of transcripts. Six individuals requested changes to the transcript. These changes involved removing detailed information, such as specifics from a description of a research project to reduce possible reidentification via direct quote or making corrections to the transcript to clarify a spoken point.

Transcripts and interview notes were reviewed using thematic analysis [39]. The data analysis team, comprised of myself as principal investigator (PI) and two graduate students, used Dedoose (version 9.0.54), a qualitative coding and analysis software program. First,

each team member conducted open coding, as described by Saldaña [40], on two interview transcripts. Considering those codes across the six transcripts, the team developed a coding schema with loose definitions and understandings that was used to code all interviews, including re-coding the initially open-coded transcripts. Each team member coded ten interviews using the agreed-upon coding scheme.

Team members used the Memos function in Dedoose to annotate reactions during the coding review process. To ensure trustworthiness, these reactions were interrogated during weekly team meetings to discuss how reactions, processing, and emotions were being incorporated into the coding. After the initial coding of each interview, a second team member reviewed the initial coding to confirm assigned codes and add additional codes as developed through team meetings. The second coding ensured the application of added codes, such as those addressing remote work and COVID-19, until saturation was reached. Team meetings routinely reviewed memos to discuss and resolve action items, such as determining coding consensus for a given transcript excerpt. As the PI, I made any final calls regarding conflicts of understanding or coding during the group coding process, consistent with recommendations on group coding [41]. In the present analysis, I delimited the findings to coded excerpts pertaining to the theme of disconnection, including isolation and relevant subcodes, and pertaining to the theme of connection, including support source, support type, and relevant subcodes. These codes aligned with Weidman and DeAngelo's [7] framework for socialization, considering personal communities, the institution of employment, and broader professional disciplinary organizations/expectations. See Table 1 for the alignment of subcode categories and socialization factors. Codes and subcodes were overlapping and nested, in that a given excerpt, for example, could be coded with both "isolation" and "remote".

*2.4. Positionality*

I identify as a white, cisgender, heterosexual, able-bodied woman born in the United States with citizenship privilege. The two graduate students who assisted with coding both identified as women with U.S. citizenship. I served as the primary researcher for interview data collection. I am currently employed as a faculty member in the field of education at a large research university in the northeast. While I have not been in a postdoc role myself, I was in a visiting assistant professor role at the time of the interviews. In addition, as the spouse and sister of individuals who were previously employed as postdoctoral scholars, I witnessed issues of connection for postdocs on a familial level. Since my research aspires to engage in allyship with underrepresented individuals and groups, this study is part of my larger research agenda as an ongoing effort toward critical praxis [42].

*2.5. Limitations*

The present study is limited due to several factors. First, participation was limited to interviewees having signed up on a first-come, first-served basis for thirty available interview slots. Therefore, this study cannot be generalized to the experiences of postdocs in the NPA. In addition, I broadly categorized participants based on demographics (such as U.S. citizen, non-U.S. citizen, broad discipline of employment, etc.) to reduce the risk of reidentification, given that it was common for participants to report being the only postdoc in their department, center, and/or school/college. Researchers have posited that categories risk deficit perspective framing and essentializing [43], and this is an important point to consider in the demographic categorization described in the present study. This study also did not collect formal information about the number of years in postdoc positions and/or the number of postdoc positions held by participants at the time of the interviews to reduce the possibility of reidentification.

My position as a researcher and my approach to this work also delimited the study, as my research question and study purpose were occasionally at odds with participant views. For example, one participant posited that connection is not an appropriate priority for a work setting, and several participants (from science or engineering areas) were

confused that the interviews and the project in general could be considered research. These participants' expressions of confusion demonstrate the disconnects present within the greater research enterprise between STEM and other disciplinary fields.

## 3. Findings

The purpose of this analysis is to examine postdoctoral scholars' experiences with connection and disconnection through a consideration of socialization theory. With a focus on postdocs' experiences with (dis)connection, the findings can help illuminate challenges and opportunities for improvement so that postdocs can feel more connected to their workplaces and continue contributing to institutional research goals. Table 1 summarizes (dis)connection code frequencies across the 30 interviews and includes total instances of a given code or category of codes across interviews. As displayed in Table 1, half of all postdocs described experiences of isolation, and 13 described issues related to remote work, a highly relevant issue in October–November 2022 when interviews occurred that continues. However, postdocs also described experiences of connection, with half of all participants describing support sources generally and 27 referring to support from their PI, mentor, and/or direct supervisor. The framework for early career socialization [7] provided nuance to partition the ways participants described experiencing (dis)connection based on their personal communities, their institutions of employment, and their professional disciplines/associations.

**Table 1.** Dis(Connection) Code Frequencies Across the 30 Interviews with Postdocs.

| Code | Number of Interviews Wherein Code Was Applied | Total Instances of Code Across All Interviews | Category Sum of Code Instances | Relevant Socialization Factor |
|---|---|---|---|---|
| Remote | 13 | 28 | 28 | |
| Isolation | 15 | 25 | 76 | |
| from family | 5 | 6 | | Individual |
| from dept | 8 | 18 | | Institutional |
| from institution | 10 | 23 | | Institutional |
| from PI/mentor | 2 | 4 | | Institutional |
| Support Source | 15 | 28 | 270 | |
| post doc association | 22 | 48 | | Prof/disciplinary |
| graduate advisor | 8 | 17 | | Personal |
| PI/supervisor | 27 | 72 | | Institutional |
| peers | 12 | 19 | | Personal |
| administrator | 7 | 9 | | Institutional |
| institution | 18 | 27 | | Institutional |
| family | 22 | 27 | | Personal |
| lab support | 9 | 18 | | Institutional |
| involvement | 2 | 5 | | Prof/disciplinary |
| Support Type | 9 | 12 | 85 | |
| career advancement | 20 | 44 | | Prof/disciplinary |
| moral support | 10 | 13 | | Personal |
| technical support | 11 | 16 | | Institutional |

Note: Subcodes were nested within parent code categories; e.g., Support source may have occurred alongside postdoc association as a subcode, etc.

### 3.1. Personal Communities

Postdocs described experiences of both connection and disconnection relating to the personal communities' factor of socialization. Kathy, a woman working in the social sciences, described how her family's support was substantial. During the interview, she shared:

> I am calling into this call from my parents' basement. So in terms of family support, I have quite a lot. Upon finishing [grad school], my fiancé and I were deciding—were we going to buy a house? Were we going to rent? The market's kind of crazy right now, what do we do? And my parents have a fully finished basement and offered us to live here until we got our feet settled. I haven't lived

in [state] in some time but was coming back for postdoc, and so they offered us to live here and not have to worry about that barrier for some time, which took a lot of stress off of us, which was amazing.

Conversely, some postdocs working in the United States on a visa expressed unique challenges of isolation because of the extreme distance from their personal communities. For example, Ling, a woman from China working in the social sciences, explained the challenges of not having family in the United States:

I know most postdocs, we're paid on similar salaries. It's hard to live by, but I think a lot of people have some foundation in this country. They don't have to take all their stuff with every time they move, because they have a family. They can put something in . . . [storage]. When things become really hard, they can get some help from their family, and those are not true for me. I just need to take care of all my things and all my business, all my finances.

These quotes demonstrate how the minimal pay for postdocs necessitates relying on family support in many cases. Individuals who are in the United States on a visa may not have the same support from their family to assist with transitioning when the next job opportunity comes up. Instead, these individuals must find a way to navigate these challenges independently.

Due to their employment in a postdoc position, several postdocs described experiencing isolation from their personal communities as contributing to their experiences with disconnection. Ignacios, a man from Greece working in the health sciences, shared:

No, really nobody can support you, right? . . . Besides the colleagues, but let's say people that are not associated in any way with academia, nobody can support you really, because everybody knows that they have their jobs and they have a certain way of living, and nothing looks like what we are doing.

This quote illustrates how the research trajectory of the postdoc position isolated Ignacios from being able to connect with others outside of work. Conversely, Christoph, a man working in engineering, described his partner as a major source of support during his postdoc. He explained:

But my partner, she's a medical doctor and she also does research. And that's where I get my support, so to speak, at home because we often have conversations about our work at home. I think it's important to have someone at home who you can talk to about your work in some degree of detail.

These statements demonstrate how family members and partners provided a great deal of support to postdocs. Taken together, personal support was not universal for participants in this study and posed particular challenges for postdocs from outside the United States, as emphasized by prior research [9].

### 3.2. Institution

The institutional factor from early career socialization theory also nuanced the ways in which postdocs experienced (dis)connection). A total of 10 interviews contained codes of postdocs experiencing isolation from their institution of employment. Sanjit, a man from India working in the natural sciences, explained: "postdocs don't have a cohort, so you come in alone, you are getting your orientations alone with some few other postdocs in different departments and maybe some staff members from the university". While academic institutions are typically set up for orienting employees by category, such as faculty, staff, and students, postdocs often fall in between these categories, resulting in isolation by design.

Some postdocs' experiences with isolation from their employing institution led to questioning their career trajectory. Mariane, a woman from Brazil working in the health sciences, described the impact of experiencing isolation:

Well, I think when you don't have connections, or when you have a little bit of the feeling that you don't belong, this makes you want to change careers sometimes or give up. So I think right now I'm thinking about changing career from academia to industry, for example, because the experience that I'm having in the university was not what I expected.

After having left a position in Brazil and moving away from her family for greater opportunities in the United States, Mariane felt that it might not have been worth it. Mariane further shared: "I don't want to spend the rest of my life feeling alone". These quotes demonstrate how feelings of isolation prompted Mariane to consider altering her career path to get out of academic research as a career. Similarly, Allan, a man from the United States working in the health sciences, explained: "It's just that there's nobody else in my position. There are no other postdocs. There's no one I can really talk to. I eat lunch alone every day. That's really the worst of it". While some postdoctoral positions are situated within a lab or department with multiple postdocs, Allan's experience demonstrates the challenge of being the only one in their status, outside of the faculty/staff/student triad.

Postdocs also described experiences of isolation from their employing institution because of COVID-19 and remote work. Christoph explained:

COVID has had a massive impact (...) because I work from home, for the most part. Most of my colleagues do too. And that means that we've lost that experience of going into the office every day and interacting regularly with my work colleagues, which I had when I was doing my PhD ... I miss that.

Like Christoph, Joyce, who identified as a woman with U.S. citizenship working in social sciences, also had minimal interactions with colleagues due to her work routine. She shared:

If I don't have to be here, and I have an office in a building across campus from the people who do the similar work that I do, then what would I get out of going in, when I can do all of my work from home anyways? That definitely did not make me feel very connected on campus.

In many cases, the continuation of remote work suggests further disconnection between postdocs and the institutions where they work.

Yet postdocs also described the ways in which important support came from institutional socialization factors, such as their PI/mentor/supervisor, the institution and/or administrative staff, and from department and lab colleagues. Shewta, a woman from India working in the natural sciences, described her PI as a critical form of support. She explained:

My PI supports me for sure. ... I have a tendency to doubt myself, or ... feel that my ideas are not big enough. My PI [has been] ... very supportive, and [said]: "Okay, you have to think about your idea ... as something that you're doing on your own". I think I lack that confidence, possibly because as a woman, I've had a tough time. You have to be so good in order to [be taken] seriously. It's been an uphill climb, so I don't want to oversell, undersell anything. It's a tough challenge. I feel completely supported ... because of my PI.

Daniella, a woman from the U.S. working in the social sciences, also described incredible support from her PIs. They provided career advancement support by giving her helpful feedback on grant applications and funding to attend conferences. She also received support in terms of taking the time she needed to determine what she ultimately wanted to pursue as a career goal after her postdoc.

Several postdocs described ways in which the institution helped them feel more connected. Adrianna, a woman from the U.S. working in the social sciences, explained:

I've only been here for four months, and it's been a great community so far. I think I am lucky in that I knew some folks at this institution prior to coming here, to moving here, and so that's been nice in that A, some of those folks have become friends in that, "Hey, you want to go to a yoga class? You want to go

climbing?" So they become social friends too. But B, they've also networked me around the university as well. So, "Oh Adrianna, I know you're trying to get skills in [technical skill], this person does that". And so I think it's very helpful that I knew some folks, a handful of folks going in, and then they have helped expand my network. I think my school does a really good job too of hosting a lot of lectures and workshops and trainings, and things like that, and then they do a good job too of disseminating information about those. And so through attending some of those things as well I feel like I've been getting connected into the school.

Adrianna's description illustrated scaffolded supports, wherein the institutional connections fostered opportunities for technical skill building and also for socializing outside of work. While her previous connection to the institution surely provided a fast track to these experiences, the school's habit of providing information about workshops and training also made it possible for Adrianna to engage in ongoing opportunities.

Postdocs also described important connections from their immediate department and lab. Darren, a man from the U.S. working in the natural sciences, described how his lab provided important support in his current and previous postdoc. He explained:

But I do feel like I very much belong in my lab and I'm able to be authentic and feel accepted in this group. And my previous postdoc at [prior institution], I very much felt at home in my lab, but I knew no one outside of my lab.

Darren's description highlights how the lab structure within the sciences can offer a form of socialization and support by structured design.

### 3.3. Professional Disciplines and Associations

Weidman and DeAngelo's [7] model for socialization also illuminates how postdocs' overall discipline and professional associations contributed to their experiences of (dis)connection. In some cases, expectations of the research enterprise within their discipline contributed to postdocs' isolation. Joyce, in the social sciences, for example, described the expectations of her position as: "It's really just entirely research focused, which is kind of nice, but also a little isolating". The focus on the research translated to high expectations for productivity but also the loneliness that came with those expectations. This connects to the isolation described by Christoph previously, in which personal connections can also be inhibited by the trajectory of a position focused on research.

Despite a return to in-person conferences and activities in the United States and around the world since the onset of COVID-19, postdocs described the continuation of largely remote opportunities for professional development within their field. Pratima, a man from India working in health science, explained:

Even after COVID, everything is Zoom. So you get emails. . . . if you feel like it's relevant or you want, you can log in, sign up and do a Zoom . . . Nowadays everything's Zoom. . . . The advantage is . . . you can [keep doing your] experiments, you can put your Zoom on and you can see it, and you can work [with] it on. So in that way, your work is not disturbed. . . still you are attending many conferences and all this stuff.

While remote opportunities provide perhaps greater access for content, this reduces the opportunity to truly focus on professional development, as there may not be a sufficient barrier between professional development and continuing the ongoing expectations of day-to-day work.

Postdocs also described ways in which postdoc associations provided means of (dis)connection. Philippa, a woman from the United States working in the social sciences, explained:

The Postdoc Association doesn't really do anything. I mean, they were very, very vocal wanting us to sign up for things for PDA week, and then after it ended,

nothing. I get more emails from the National Postdoc Association thing than I've ever received from the university.

Philippa's point emphasizes the need for more consistent investment in a postdoc association. Jayant, a man from India working in the social sciences, called upon his employer to ensure that there was a means of positive socialization through investing in a postdoc association when he stated:

So having that community, that community should not be just the postdocs. I mean, anybody can form the community and we can just support ourselves, but that doesn't go anywhere. That is always there. We can get it from your friends, get it from your family, but that community should be from the administration, some of the administrators should be part of that.

This commitment to starting a postdoc association at the institution created opportunities for postdocs to have more positive socialization experiences. For example: Avanti, a woman from India working in the health sciences, stated: "We have a very social Postdoc Association here in my university and I'm well connected to it". Similarly, Sudarshana, also a woman from India working in the health sciences, said that being part of a national effort to convene postdocs while she lived in another country was a meaningful experience. She explained:

I was part of a team and we had organized a national postdoc symposium . . . Just before I came here. It was wonderful. . . . it took 10 months of preparation, and we had invited participants from all over different places . . . postdocs, and PhD students. Our aim was to create a good platform for the early career researchers to understand the different areas where they can go in. The problems faced by them, mental health, including mental health problems, we had a talk on that too. Time management, then other skill developments, I was part of that, and it was a wonderful experience for me to develop my soft skills. I think it really helped me here too in my present campus. Also, I'm involved in postdoctoral activities, I'm participating in some workshops training for postdocs.

Avanti and Sudarshana highlighted how professional organizations and structures specifically designed for postdoc participation can help to build these connections, as emphasized by translational research in the health sciences [44]. Ling summarized the importance of these organizations when she explained:

I think another thing to mention is [to] not let the postdoc be isolated on their own island. If their little island is not a place they can find a sense of belonging, make sure they have some other mechanisms where they can find a sense of belonging. . . . I know there are [opportunities at the] national level, the NPA, so make sure that postdocs have those external systems they can be connected with.

This quote provides evidence for the need for professional associations to provide a place for postdocs to find meaningful connections, especially when personal and institutional connections may be hindered by a postdoc position. Postdocs' comments about the importance of professional associations connect to the Shahr et al. [8] analytical definition of professional socialization, which includes "continuous, interactive . . . and interactional factors [p. 1]. Philippa's experience indicated how the lack of continuation negatively impacted her experience, while Sudarshana indicated how her engagement in prior organizing positively impacted her involvement at her new campus in the United States.

## 4. Discussion

This study examined how postdocs experienced (dis)connection. Too often, postdocs' experiences fall short of the benefits experiencing meaningful connections can offer in an employment setting [45]. While prior research has emphasized that international postdocs employed in the United States experience unique challenges due to their visa status [9], this study responds to the NPA's call for better understanding these challenges [9], as described by Ling and Mariane. This analysis also responds to Feldon's [35] call for qualitative studies

to investigate the nuanced interactions among individual, institutional, and professional socialization and how these factors interact.

The unique contribution of the present analysis extends prior theory on socialization [7,8] and provides practical implications for institutions employing postdocs. Since this study involved 30 postdocs across disciplines, the findings offer insight into the ways in which the postdoc experience can be similar despite appointments in varying disciplines. The findings from this study highlight the need to create formal structures for postdoctoral scholars to establish connections that can combat postdocs' experiences of isolation, limit disconnection, and better facilitate connection. The following subsections consider the theoretical and practical implications of the present analysis.

### 4.1. Theoretical Implications

Considering findings from Weidman and DeAngelo's [7] model of socialization and Shahr et al.'s [8] definition of professional socialization nuances how postdocs experienced (dis)connection at the personal, institutional, and association/discipline levels. This study extends socialization theory as currently defined to a consideration of postdocs within higher education and the broader research enterprise. While prior research has examined socialization for graduate students and early career professionals [7,34], the present study specifically examined postdocs' connection experiences through a socialization lens. In the same way that socialization theory indicates that supports (and lack thereof) can come across as factors for graduate students and early career professionals, the postdocs in the present analysis also expressed nuanced ways in which they experienced (dis)connection through these domains of socialization. To be sure, the postdoc experience is not a monolith, as socialization theory has long posited for other constituent groups such as undergraduates [34], graduate students [34], and early career professionals [7].

Shahr et al.'s [8] analytical definition of professional socialization also provides an avenue to extend the socialization model for the consideration of postdocs. The definition of professional socialization suggests that the process occurs through "individual, organizational, and interactional factors" [8] (p. 1), and the findings from the present study corroborated the ways in which postdocs' experiences across these domains, or lack thereof, facilitated or hindered connection. Since the postdoc position has been designed to be "training for the purpose of acquiring the professional skills needed to pursue their chosen career path" [1] (para. 1), the Shahr et al. [8] professional socialization definition provides further nuance to socialization theory [7] for postdocs. Specifically, the findings from this study emphasized the importance of ongoing interactional factors, which add further dimension to the professional association/discipline domain of Weidman and DeAngelo's [7] socialization theory. For example, Joyce experienced a lack of interaction in her daily work routine and isolation because of the high research expectations, while Avanti and Sudarshana had positive experiences engaging in professional development activities designed for postdocs. While Allan ate lunch alone every day, Darren felt connected to his lab in his current and prior postdoc positions. While the Weidman and DeAngelo [7] socialization model included professional associations and discipline expectations and norms, Shahr et al.'s [8] definition called for "continuous, interactive" (p. 1) processes across domains. Therefore, this study offers a way to specify socialization theory for postdocs by incorporating Shahr et al.'s [8] definition.

### 4.2. Implications for Practice

Institutions need to take responsibility for creating a more inclusive climate, and this study would suggest that this need can extend to institutions employing postdocs. Recent recommendations from the National Institute of Health [19] and the National Postdoc Association [46] provide key recommendations that build upon prior work from scholars who have called postdocs "the invisible scholars" in the title of their book [33]. The findings from the present study outline actionable steps that can be taken now by PIs, institutions, and the greater research enterprise.

First, supervisors of postdocs can address isolation and a lack of connection to ameliorate postdocs' experiences in the workplace. The participants in this study linked isolation to reduced engagement, such as Mariane. Addressing isolation therefore matters because prior research has demonstrated that postdocs are critical to graduate student learning [5,6] and the research enterprise [4]. Numerous participants talked about critical support from their PI, such as Daniella and Shewta. PIs must ensure that mentoring is part of their portfolio when supervising postdocs, and other literature has delineated the specifics of how these interactions can be mutually beneficial [47].

Second, this study further demonstrates the need to engage postdocs in more highly structured professional development and training opportunities, which previous research suggests would benefit postdocs to support their success inside or outside of the academy [29]. To be clear, institutions of higher education and other institutions employing postdocs can do more to ensure that postdoctoral scholars have the structures and supports they need to engage. For instance, while Philippa had a one-and-done experience with postdoc association week at her institution, Avanti and Sudarshana indicated how their interactions occurred over time and built stronger connections and meaning. Research shows that institutions need to develop greater support for postdocs to address this lack of connections [28], and the evidence provided by participants mirrored that, such as Jayant's emphasis on the need for administrators to be involved in building postdoc communities. Institutions can offer more structured opportunities, such as a postdoc association and in-person trainings, to increase postdocs' sense of connection. To be sure, some postdocs may not choose to attend formalized opportunities, yet the choices of certain individuals should not preclude others from having opportunities.

Third, the present study provides the unique contribution of illuminating how postdocs' experiences of (dis)connection present specific opportunities to better engage postdocs in the process of professional socialization [7,8]. Institutions of higher education and postdoc employers can take initiative to develop the systems and supports recommended by the NPA [9,46] and NIH [19], such as standardized onboarding, minimum compensation, equal benefits regardless of funding status/source, and professional training opportunities. Implementing these types of standards and practices can serve as a signal from employers to postdocs that there are, in fact, other postdocs within an institution. Building connections between hiring processes within specific labs and departments needs to be centralized by the employing institution so postdocs can have the opportunity to connect with other postdocs.

Finally, this study demonstrates how important it is for institutions to recognize the changes that occurred in the workplace as a result of the COVID-19 pandemic. Many of the participants in this study discussed changes in the workplace due to the lack of in-person events and limited socializing over web conferencing tools. While some of the participants have reasons not to venture to campus frequently, workplaces should be providing ways to build networks and connections. Professional socialization for postdocs needs to consider the reality that remote work is here to stay [48]. The staying power of remote work necessitates designing ways in which postdocs can truly interact with these opportunities, as opposed to being expected to tune in while maintaining their day-to-day responsibilities, as expressed by Pratima. While remote opportunities can extend access to participation among postdocs working at off-site research centers apart from the main campus, for instance, such offerings must be designed to specifically create ways for participants to connect. Intentional design for socialization within remote settings has been shown to promote connectivity and productivity among employees [49]. Creating opportunities for postdocs to connect can therefore not only lead to reducing isolation but also to greater research productivity and retention of staff, offering benefits for individuals within postdoc positions, their employing institutions, and the broader research enterprise.

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