Solving the Puzzle of Recruitment and Retention—Strategies for Building a Robust Clinical and Translational Research Workforce

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Abstract

This paper is the first in a five-part series on the clinical and translational science educational pipeline and presents strategies to support recruitment and retention to create diverse pathways into clinical and translational research (CTR). The strategies address multiple levels or contexts of persistence decisions and include: (1) creating a seamless pipeline by forming strategic partnerships to achieve continuity of support for scholars and collective impact; (2) providing meaningful research opportunities to support identity formation as a scientist and sustain motivation to pursue and persist in CTR careers; (3) fostering an environment for effective mentorship and peer support to promote academic and social integration; (4) advocating for institutional policies to alleviate environmental pull factors; and, (5) supporting program evaluation—particularly, the examination of longitudinal outcomes. By combining institutional policies that promote a culture and climate for diversity with quality, evidence-based programs and integrated networks of support, we can create the environment necessary for diverse scholars to progress successfully and efficiently through the pipeline to achieve National Institutes of Health's vision of a robust CTR workforce. Clin Trans Sci 2015; Volume 8: 563–567

Keywords: clinical and translational research, workforce, pipeline, education, training, career development, recruitment, retention

The Clinical and Translational Science Award (CTSA) program was developed by the National Institutes of Health (NIH) to infuse biomedical research with new perspectives, methodologies, and technologies. Central to this mission, the CTSA program was charged with enhancing education, training and career development programs to create a more "robust translational research workforce."[1] This paper is the first in a five-part series on the clinical and translational science educational pipeline. The overall goal of this series is to describe how Clinical Translational Science–awarded institutions may develop an effective educational pipeline along the entire academic and career development continuum.

This first paper provides the context for the series. We present strategies to support recruitment and retention across an expanded pipeline to create diverse pathways into clinical and translational research (CTR). Attention is also given to future workforce development needs. The next four papers focus on crucial steps along the educational pipeline: (1) How to recruit the most promising high school and undergraduate students to careers in CTR; (2) How graduate school programs (for PhDs and MDs) should prepare students for the future needs of the CTR workforce; (3) How to build effective career development programs for junior investigators; and, (4) How to enhance team science in CTR: the role of effective leadership. All five papers were written collaboratively by leaders of CTSA education, training, and career development (ETCD) programs.

The NIH has consistently emphasized the need to diversify the clinical, biomedical, and social/behavioral science workforce. The 2014 CTSA request for applications (RFA) encouraged academic institutions to diversify their student and faculty populations and increase the participation of individuals currently underrepresented in the sciences. Specifically, the RFA noted that: "The NIH expects efforts to diversify the workforce to lead to the recruitment of the most talented researchers from all groups; to improve the quality of the educational and training environment; to balance and broaden the perspective in setting research priorities; to improve the ability to recruit subjects from diverse backgrounds into clinical research protocols; and, to improve the Nation's capacity to address and eliminate health disparities."[2] Thus, within the CTSA context, as well as other major initiatives, NIH is promoting efforts to ensure that a variety of fields of knowledge, and ways of knowing, are applied to our most daunting health challenges and to elucidate the least well-understood or most intractable disease processes.

We have identified five overarching strategies that ETCD programs should consider in addressing this challenge, and thereby expand and enhance their educational pipelines. These strategies were informed by our experience leading and evaluating programs across the educational and career development continuum, as well as by extensively reviewing the relevant literature across multiple disciplines. From this background work, the following five recommendations for ETCD programs surfaced: (1) Create a seamless pipeline by forming strategic partnerships to achieve continuity of support for scholars and collective impact; (2) Provide meaningful research opportunities to support identity formation as a scientist and sustain motivation to pursue and persist in CTR careers; (3) Foster an environment for effective mentorship and peer support to promote academic and social integration; (4) Advocate for institutional policies to alleviate environmental pull factors; and (5) Support program evaluation—particularly, the examination of longitudinal outcomes—to guide such efforts and respond to the changing demands of this endeavor.

Each of these strategies is equally important to the recruitment and retention of CTR investigators and is relevant across the entire educational pipeline. Recruitment and retention are processes shaped by many factors internal and external to the individual. Therefore, these five strategies target multiple levels (including individuals' social support networks and institutional culture and

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Funding support provided by NIH/NCATS Colorado CTSI Grant Number UL1 TR001082.

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DOI: 10.1111/cts.12277

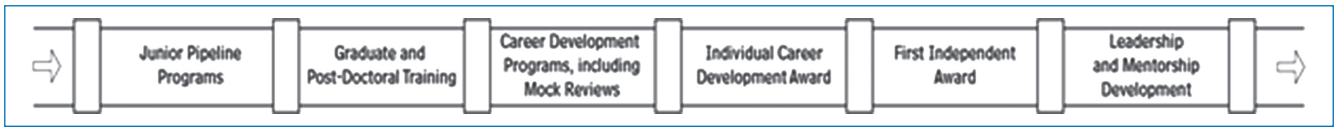

Figure 1. Seamless pipeline for enhanced recruitment and retention at every stage of academic and career development.

climate) to help create the environmental conditions necessary to achieve and sustain a robust CTR workforce.

Create a Seamless Pipeline to Achieve Continuity of Support and Collective Impact

To attract the best individuals and augment the trajectory and success of their careers, ETCD programs must help scholars navigate challenging transition points. Examples of these transitions include the shift from: (1) high school or community college to a 4-year academic institution, (2) postdoctoral training to the first academic appointment, and (3) a career development award to receiving the first independent award (K to R transition). Even the most talented investigators can experience diminished productivity as they navigate these critical milestones of academic and professional advancement. Adequate preparation, mentorship, and institutional support can prevent "stop out" (resulting in gaps in transcripts/CVs) and "drop out" (exiting the pipeline altogether), which are more likely to occur at these transition points.

A "seamless" pipeline represents the collective efforts of multiple programs and partners, operating in an intentional, coordinated fashion to ensure that each scholar receives continuity of support that is responsive to their unique education, training, and career development needs. The seamless pipeline concept, therefore, implies a shared responsibility for the success of each scholar. By strengthening the seams of support across critical academic and career development transitions, aligned programs can reduce the likelihood that promising scholars will fall through the cracks that may exist when individual programs operate in relative isolation. For example, through enhanced communication and coordination, program referrals and transitions can be supported in a more continuous manner than is often the case. At a systems level, the resulting integrated network of programs can more effectively address the constellation of factors that affect educational attainment and career development. By avoiding duplication of effort and ensuring that potential gaps in support are adequately addressed, continuity in preparing CTR investigators becomes more feasible with the promise of optimizing limited resources. Enhanced program collaboration can also facilitate the collection and sharing of information about programs and their participants. Thus, an information infrastructure should be created to support achieving a larger referral network and more rigorous evaluations that are poised to examine longitudinal outcomes—the collective impact of the seamless pipeline.

ETCD programs must engage pipeline programs as essential partners. Pipeline programs are most commonly thought of as those that focus on earlier stages of academic and career development and reach as far back in the educational pipeline as middle school and high school. A robust body of evidence demonstrates the effectiveness of pipeline programs for increasing the diversity of students interested in pursuing careers in the health professions, including biomedical research.[3] Importantly, in this paper, pipeline programs are defined broadly as those designed to pique and sustain interest in, and motivation to pursue and persist in, CTR careers. As such, they include standard CTSA ETCD opportunities such as degree-granting educational programs, mentoring programs and programs that foster team science. Realizing the seamless pipeline concept (as depicted in *Figure 1*) requires ETCD programs to work in conjunction with programs that focus on earlier stages of the pipeline to optimize recruitment and retention at every step along the academic and career trajectory.

As an example, the ETCD core of the Colorado Clinical and Translational Sciences Institute (CCTSI) has partnered with the University of Colorado's Office of Diversity and Inclusion (ODI) to "strengthen the seams" of the educational pipeline. The partnership has resulted in a systems-wide initiative—the **I**ntegrated network for **P**romoting **A**cademic and **C**areer **T**rajectories (ImPACT), which regularly convenes stakeholders from the four University of Colorado campuses through monthly video conferences and face-to-face meetings. ImPACT has formally adopted a "seamless pipeline framework," which identifies key factors that predict engagement, achievement, and persistence at critical stages of education and career development. A comprehensive inventory of pipeline programs across the four campuses is currently underway. The goals of this effort are to: (1) align pipeline program efforts to identify strengths and areas where there may be gaps in support that can be addressed through the establishment of new, strategic partnerships; (2) identify opportunities to streamline administrative and programmatic functions, such as the processing of applications and planning of program events; (3) establish a common portal to enhance the visibility of, and access to information about, these programs and services; (4) facilitate smoother transitions between programs to achieve continuity of support; and, (5) standardize the collection of information on a common set of metrics. Similar efforts to work in partnership across institutions and sectors can enhance the capacity of CTSAs to contribute to the CTR pipeline.

Provide Meaningful Research Opportunities to Support Identity Formation as a Scientist and Sustain Motivation to Pursue and Persist in CTR Careers

"Meaningful" implies authentic: the notion that research experiences are realistic and, thus, allow individuals to develop academic confidence, valuable research skills and self-efficacy as a scientist.[4,5] For example, pipeline programs designed to expose high-school students to summer research opportunities must introduce participants to the topic and purpose of the research project so that they understand the larger context of the tasks they will be completing. In this way, participants will develop a deeper understanding of how the discrete steps in the research process are connected to testing a specific hypothesis and associated contributions to scientific knowledge in a given field. For undergraduates, robust research experiences strengthen

Strategic: supports planned goal setting and critical decision making (e.g., regarding decisions that are pivotal to attaining academic and career milestones). Reflection: How does my mentor assist me in maturing my vision?
Analytic: deciphering options, opportunities, pitfalls, pathways (i.e., the development of strategies to reach goals). Reflection: How does my mentor assist me in determining how to achieve or realize my vision?
Operational: skills-based mentorship (e.g., how to craft a persuasive piece of scholarship). Reflection: How does my mentor support me in developing new, or honing existing, skills?
Instrumental: facilitating access to key resources, such as lab space, facilities, funding, other mentors. Reflection: How does my mentor assist me in accessing needed resources/services?
Affective and emotional support: involves providing empathy and encouragement that helps a mentee reengage with a challenging task and sustains motivation. Reflection: How does my mentor respond when I feel discouraged or when I have experienced a setback/disappointment?
Inspirational: facilitating access to role models who have direct, lived experience with aspects of a given mentee's path, who can, therefore, provide empathy as well as grounded strategies for navigating obstacles to success. Such mentors serve as a source of hope and encouragement as someone who faced some of the same struggles, yet persevered. Reflection: In what way(s) is my mentor like me? What wisdom might s/he have to offer that I can apply in navigating my own path to success? To what extent does my mentor understand some of my challenges and struggles?

Table 1. Cross-cutting functions of effective mentorship.

retention in the educational pipeline by supporting (1) intentions to pursue a given course of study, (2) academic achievement, and (3) identity formation—specifically, the development of a self-concept and values that are consistent with being a scientist.[6,7]

"Meaningful" also refers to research experiences that have personal, academic, and professional relevance, and, thus, are intrinsically interesting and/or motivating.[8] The trainee must feel some degree of enthusiasm for the topic; otherwise, s/he may lose interest in the specific project and ultimately choose not to pursue a research career. While career development programs tend to focus on the extrinsic motivations of achieving critical career milestones (e.g., one's first independent research award), intrinsic motivations (e.g., being able to pursue research to help one's patients) are equally important to career persistence and retention in the pipeline. In our own work with career development awardees, early-stage investigators describe how the angst of not having answers for patients has motivated them to pursue and persist in CTR careers, despite regulatory obstacles or a sense that they lacked institutional support for their research.

Infusing research with enhanced meaning may be one of the more underreported and underappreciated outcomes of team science. A case study analysis of team science, conducted for the CCTSI, revealed that collaborations between basic and applied scientists promoted a sense of integration into a broader community of scholars and scientists. These collaborations also help basic scientists to assign deeper meaning to their research as they come to understand its broader, translational implications. CTSAs should consider promoting team science, not only to foster new discoveries and insights, but also to promote retention in the CTR workforce through the establishment of fruitful research collaborations and, by extension, engagement in meaningful research opportunities.

For students and faculty, alike, the ability to pursue research interests and to engage as a member of a vibrant research team often instills a sense of autonomy, competence, self-efficacy, and relatedness to the academic environment and institution.[9] Engaging scholars in meaningful research opportunities fuels motivation at every stage of the pipeline. For young, aspiring and more established scientists, engaged research is experienced as meaningful and crystallizes interests and intentions to excel in a CTR career. ETCD programs can foster this potential by scaffolding opportunities, as part of career development planning, for scholars to reflect on or reconnect with how their research interests and career support their values and goals. Mentors should play a key role in helping mentees to clarify goals and motivations, and further support trainees in drawing upon these insights to pursue research opportunities that will achieve a personally meaningful CTR career.

Foster an Environment for Effective Mentorship and Peer Support to Promote Academic and Social Integration

Students and faculty who feel socially and academically integrated are less likely to leave a specific institution and the academic environment in general.[10] Fostering social and academic integration is especially important for expanding pathways in academic settings that lack racial, ethnic, gender, and other types of diversity.[11,12] Programs that enhance academic and social integration are, therefore, important components of an effective educational pipeline. Mentorship and peer support are two of the most effective strategies for promoting social and academic integration.

Mentorship must fulfill a number of cross-cutting functions to promote academic and career development and retention. Specifically, effective mentorship assists with: (1) setting strategic goals; (2) devising pathways to success that include alternative strategies when challenges emerge; (3) assessing and accessing necessary resources and services; (4) developing professional competencies, including skills related to managing the work environment; and, (5) receiving emotional support to sustain commitment along the way.[13] *Table 1* presents our perspective regarding the multiple dimensions of effective mentorship, including its importance in facilitating access to role models who can share wisdom and serve as a source of inspiration (i.e., as someone to emulate).

To enhance the environment for effective mentorship and ensure that investigators develop effective mentoring relationships, training programs should be established to teach mentorship-related skills to both mentors and mentees. The CCTSI Colorado Mentor (CO-Mentor) program, for example, trains mentors and mentees as dyads and combines didactic training components with structured opportunities for practice and reflection. ETCD cores might also consider tracking when mentee participants

return to such programs in the role of a mentor, as an important indicator of persistence at an individual level, and of an enhanced environment for mentorship at an institutional level.

Peer support facilitates academic and social integration by connecting scholars to individuals who share similar academic goals, research interests, sense of purpose, as well as backgrounds. Peer networks can enhance the support available to individuals who may otherwise lack access to information, other types of resources and emotional support. Importantly, establishing affinity groups and peer networks is an effective way to engage underrepresented minority students and address feelings of isolation and the culture shock that can be experienced by first-generation college students.[14] Providing mechanisms and structures to connect students and facilitate the development of peer support can affirm a sense of belonging.[15] Among faculty, efforts on the part of ETCD programs to foster the development of peer networks and support can also help address issues of burnout and, thus, improve retention. The Leadership in Innovative Team Science (LITeS) program at the University of Colorado Denver is a year-long program designed for senior and midcareer faculty who aspire to improve their management and leadership skills. Through team-based projects and other interactive training components, faculty from diverse departments, schools/colleges, and institutions form enduring connections. An important outcome of the program is expanded professional networks that participants report they can call on as they fulfill leadership roles and responsibilities. LITeS participants report an improved sense of social connection, renewed energy for their professional roles, and stronger commitment to the academic institution.

Advocate for the Establishment of Institutional Policies to Help Alleviate Environmental Pull Factors

Environmental pull factors are the conflicting demands that compete with investigator engagement, integration, performance and, ultimately, retention. Environmental pull occurs across the educational and career development pipeline. For undergraduate students, such pulls may include financial needs or obligations that require them to work full- or part-time jobs to pay for school, yet constrain study time or the ability to remain on campus to participate in student groups or other activities that might support their social and academic integration. For early-stage investigators, environmental pull factors may demand that they navigate enticing offers to serve in new roles in administrative capacities or as reviewers on national committees. While these opportunities may represent career advancement in the short term, they ultimately threaten research productivity and can compromise promotion and tenure. As these examples highlight, environmental pull can detract from students'/investigators' ability to focus on their studies/research, the reward they may otherwise experience from these endeavors, and can negatively affect academic and professional self-efficacy.

While such environmental pulls may seem inevitable, institutional policies can alleviate these factors and thereby support academic and career persistence. As such, we urge ETCD programs to advocate proactively for institutional policies that support an expanded pipeline and, by extension, a robust CTR workforce. The following are examples of such policies that not only address common environmental pull factors, but that also serve to support the strategies highlighted earlier in this paper:

1. **Policies to Promote Integrated Networks of Support Locally and Nationally:** In the first section of this paper, we described how strategic partnerships (for example, between ETCD cores and more traditional pipeline programs) can optimize the pipeline by enhancing support across key transitions in the education, training and career development pathway. We also challenge CTSAs to operate as an integrated network that enables trainees, scholars and investigators to move strategically and seamlessly across institutions to support their career trajectories. Such moves between institutions to advance one's career represent another key transition, during which there may be a loss of funding, mentorship, and access to other types of resources and services. Consequently, individuals undergoing such transitions often need to secure new resources and sources of support or suffer diminished research productivity. CTSA-supported investigators should be thought of as a shared resource worthy of common investment and should receive continued support across institutions. To optimize CTSAs' capacity to function as an integrated network of support, the National Center for Advancing Translational Sciences (NCATS) should consider establishing policies, for example, that require comentorship of an investigator for some period of time to facilitate his/her seamless transition between institutions. NCATS might also consider allowing multiple CTSAs to report the research productivity of a scholar when s/he has only recently transitioned between institutions. Finally, NCATS should establish a centralized database to support the longitudinal tracking of trainees and scholars supported by CTSA awards. This information would support research on education, training and career development within a CTSA context, including an examination of the current state of the CTR pipeline. Easy access to such a database would be invaluable to efforts to assess the collective impact of the CTSA consortium in building a robust CTR workforce.
2. **Policies that Promote Engagement in Meaningful Research:** CTSAs are charged with maintaining a balanced portfolio of research across the translational spectrum. CTSA leaders have a vested interest in ensuring that institutional policies appropriately support a diverse array of investigators with unique skills and predispositions to support this entire portfolio. However, promotion and tenure policies, as well as regulatory requirements, often perpetuate traditional models of individual scientists working in relative isolation, and can introduce unnecessary barriers to interdisciplinary, team-science endeavors or different types of relevant research, such as community-engaged research. Lack of institutional support in this regard otherwise compromises investigators who may be well-suited to the unique demands of such endeavors. Therefore, CTSA leaders should advocate for modifications to tenure and promotion policies, as well as regulatory requirements. Such changes likely will facilitate expanding the pipeline to include more diverse scientists, and thus promote a vibrant research community that is well poised to take advantage of future funding opportunities.
3. **Policies that Raise the Bar for Effective Mentorship:** Mentorship is a mission-critical aspect of the CTR enterprise, at an institutional and national level. The viability of biomedical research institutions is tied to the robustness of the educational and career development pipeline; the future workforce is, in turn, predicated on effective mentorship. Effective mentorship is carried out by those who hold expert knowledge, not only

in a specific content area, but also in terms of how to navigate academia. Effective mentors also display a wide array of skills as they support multiple trainees and scholars through career development pathways, assessing and responding to their unique needs, personality types, and communication styles. Thus, there should be a high premium on policies that elevate effective mentorship as a profession and highlight effective mentors as institutional assets. Such policies should also ensure that effective mentorship is more uniformly available, particularly to those at earlier stages of the academic and career pipeline. To ensure that mentorship is consistent and of high quality, its basic elements should be carefully operationalized, rigorously evaluated, and acknowledged, as well as rewarded, by the academic community.

By focusing on policy-level initiatives, systemic change can be realized to alleviate or achieve an appropriate balance between environmental pulls. In order to expand pathways into CTR careers, institutional policies of this nature should focus on promoting the full spectrum of translational research and protect early-career investigators from demands that may, ultimately, undermine their longer-term success. These policies should also provide the structural supports necessary to maximize the impact of other strategies for expanding the pipeline. By combining these strategies in purposeful ways, we can create a culture and climate that promotes diversity among faculty and students.

Conclusion

This paper underscores the importance of an intentional, long-term commitment to expanding pathways to CTR careers—work that should target multiple levels. To be effective, such efforts must extend the pipeline to include early academic and career development to ensure there is continuity of engagement and support across the various contexts that shape persistence decisions. Achieving a seamless pipeline will only be feasible through the establishment of strategic partnerships, which include but are not limited to existing pipeline programs that have been shown to be effective. These cross-sector, collaborative efforts should be anchored by agreed-upon measures of success that all partners work toward achieving in a coordinated fashion. By combining institutional policies that promote a culture and climate for diversity with quality, evidence-based programs and integrated networks of support, we can create the environment necessary for diverse scholars to progress successfully and efficiently through the pipeline to achieve NIH's vision of a robust CTR workforce. It is especially important that we pursue this agenda not just within our family of programs, but also reach out to other initiatives, such as NIH's new National Research Mentoring Network, to capitalize on the growing commitment to this goal and the attendant resources.

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