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Understanding Career Success and Its Contributing Factors for Clinical and Translational Investigators

Georgeanna F.W.B. Robinson, EdD,

Assistant director, Institute for Clinical Research Education, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania

Lisa S. Schwartz, EdD, MS,

Assistant research professor, Department of Clinical Research and Leadership, and associate director of research education, training, and career development, Clinical and Translational Science Institute, Children's National Health System, George Washington University School of Medicine and Health Sciences, Washington, DC

Linda A. DiMeglio, MD, MPH,

Professor of pediatrics, Department of Pediatrics, Section of Pediatric Endocrinology/Diabetology, Riley Hospital for Children, Indiana University School of Medicine, and director, Career Development, Indiana University Clinical and Translational Sciences Institute, Indianapolis, Indiana

Jasjit S. Ahluwalia, MD, MPH, and

Dean, School of Public Health, Rutgers University, New Brunswick, New Jersey

Janice L. Gabrilove, MD

James F. Holland Professor of Medicine and Oncological Sciences, and associate director, Education and Training, The Tisch Cancer Institute; and director, Clinical Research Education Programs, and co-director, KL2 Scholars and PORTAL Programs, Icahn School of Medicine at Mount Sinai and Graduate School of Biomedical Sciences, New York, New York

Abstract

Purpose—To understand the factors that facilitate career success for career development awardees in clinical and translational science and to reconceptualize understanding of career success for this population.

Method—In 2013–2014, the authors conducted semi-structured interviews with former NIH KL2 or K12 scholars from nine Clinical and Translational Science Award-funded institutions.

Correspondence should be addressed to: Georgeanna F.W.B. Robinson, Institute for Clinical Research Education, 200 Meyran Ave, Suite 300, Pittsburgh, PA 15213; telephone: (412) 864-3024; gwrobins@pitt.edu.

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Participants either had or had not secured independent funding at least two years after the end of their last K award. Questions covered the factors that facilitate or hinder junior investigators' transition to independent funding. Interviews were recorded and transcribed and the transcripts analyzed thematically.

Results—Forty individuals participated, with equal representation by men and women and by independently and not independently funded investigators. Personal factors that facilitated success included: networks, persistence and resilience, initiative, autonomy, and personal and professional balance. Organizational factors included: appropriate mentorship, protected research time, and institutional resources and support.

Even independently funded participants described challenges regarding career direction. Five participants without independent funding modeled a broad spectrum of successful career paths, having assumed leadership positions not reliant on grant funding. Alternative definitions of career success included: improving public health, enjoying work, seeing mentees succeed, and receiving external acknowledgement of successes.

Conclusions—Awareness of the factors that facilitate or hinder career success can help junior faculty, mentors, and institutional leaders support career development in clinical and translational science. New definitions of career success are needed, as are career paths for faculty who want to engage in research in roles other than principal investigator.

The “leaky pipeline” in academic biomedical research has been well documented.^{1–3} The National Institutes of Health (NIH) has taken steps to address the high rates of investigator attrition in academia, including creating special policies and funding opportunities for early-career investigators. Career development awards (called K awards when funded by NIH) provide junior faculty with protected time to conduct research and engage in training under the guidance of a mentor, with the purpose of providing them with the training and data acquisition necessary to secure independent funding.⁴ In taking these steps, NIH aimed to help investigators navigate the portion of their career path where many change trajectories—the transition from a mentored trainee to an independent principal investigator (PI). Nevertheless, the rates of transition from a K award to independent funding are low. Fewer than 25% of K awardees receive an independent research grant (R01) within five years of receiving a K award,⁵ and only 10%–11% obtain a second R01.⁶

K awardees need substantial support to become competitive as independent investigators in today's highly competitive funding environment. Some institutions with a Clinical and Translational Science Award (CTSA) created “K to R” programs that facilitate the transition to independent funding for their K awardees, but little research has evaluated the effectiveness of these programs, which are heterogeneous in design. Studies of specific programs, however, have found that some organizational or personal factors do contribute to this transition.⁷ These organizational or program factors include: the augmentation of research funds by private sources (e.g., foundations),⁸ mentoring^{9,10} (particularly when centrally overseen¹¹), protected time for research training,¹¹ grant writing training and support,¹⁰ time management training,¹⁰ and access to statisticians and other experts.¹⁰ Personal factors include: experience publishing peer-reviewed papers early in one's career¹² and early submission of extramural grants.¹¹

As the moniker “K to R” suggests, the purpose of these programs is to provide early-career faculty with the additional support they need to secure independent funding for their research. This transition has traditionally been an important metric by which investigators’ career success has been judged. In recent years, however, team science has become more important for advancing new knowledge¹³ and federal grant funding has declined.¹⁴ These changes suggest the need to reconsider the traditional concept of “success” for clinical and translational investigators, to reflect both the manner in which research is often conducted and the funding climate. They also suggest the need for a new understanding of the definition of a successful career path and of the metrics to evaluate success.¹⁵

Rubio and colleagues¹⁶ suggested a comprehensive model of career success for physician-scientists that has yet to be tested empirically. It details the personal and organizational factors that contribute to various types of success, which may be extrinsic or intrinsic. Extrinsic success is readily visible to others, such as financial success (both personal finances and grant funding), publications, leadership positions, and promotions in academic rank. Intrinsic success is more subjective and personal, mainly centering on career and life satisfaction, such as whether individuals feel they have achieved their self-defined career goal(s).

In 2012, the CTSA Education and Career Development Key Function Committee formed a work group to examine the factors that facilitate or hinder K awardees’ transition from a mentored career development award to independent funding. A subset of the members of this group conducted a qualitative study, based on the Rubio model of career success, to examine the personal and organizational factors that support or hinder this transition from an institutional mentored career development award (KL2 or K12) to independent funding (R01 or R01-equivalent funding). In addition, this work group wished to gain insight into K awardees’ definitions of career success.

Here, we report the findings of this study, including the personal and organizational factors that participants identified as facilitating a successful transition to independent funding, their perceptions of career success, and some of the career challenges they experienced.

Method

We designed a semi-structured interview guide, which included questions that covered the main elements in the Rubio model of physician-scientist career success,¹⁶ such as psychosocial factors, education, personality (research motivation, passions, leadership, professionalism), career support, professional responsibilities, and success factors. We also included questions about career plans, concerns, regrets, and factors that helped or hindered career progress. In total, there were 20 questions (see Supplemental Digital Appendix 1 at [LWW INSERT URL]). We piloted the questions with four KL2 alumni volunteers from a large Midwestern CTSA-funded institution, refining the questions as appropriate after the pilot.

Since organizational factors could play a role in career success,¹⁶ we wanted participants to come from a number of institutions across the United States. We chose to include alumni

from KL2 programs and the KL2 program precursor, the Roadmap K12 (hereafter referred to collectively as “KL2”), because we assumed that institutions with CTAs would provide substantial centralized support for their KL2 scholars. This purposive sampling¹⁷ allowed us to capture investigators who either had or had not transitioned to independent funding, despite supportive institutional structures to help them succeed, deepening our understanding of the factors that facilitate or hinder career progression. We reviewed institutional websites to determine which institutions with CTAs awarded in 2006 and 2007 had the most KL2 alumni. We limited the data to these two years to ensure that a reasonable time had passed from the start of participants’ K awards to their possible transition to independent funding. We selected 10 institutions to achieve geographic representation, as well as a balance of public and private institutions. The University of Pittsburgh institutional review board deemed this study exempt. All participating institutions either obtained approval from their respective institutional review boards or did not need it because data collection and storage took place at the University of Pittsburgh.

We asked KL2 directors and administrators to identify faculty who had been supported by their KL2 mechanism and who met either of the following criteria: (1) had secured an R01 or grant of an equivalent size as PI or had scored in the top quartile for an R01 application; or (2) had not secured an R01 or equivalent grant as PI and for whom two years or more had passed since the end of their last career development award (including an individual K award they may have been awarded subsequent to the KL2). Administrators asked eligible alumni to contact a member of the study team if they were willing to participate. We aimed to interview 40 alumni in total—20 independently funded (IF) and 20 not independently funded (NIF) individuals. If we did not reach theoretical saturation after these interviews, we planned to continue the interviews until no new themes emerged.

One member of the study team (G.F.W.B.R.) conducted all the interviews between July 2013 and April 2014. Interviews were conducted using either video-conferencing software (n = 22; 55.0%) or in person meetings (n = 7; 17.5%), with the remaining interviews conducted over the telephone (n = 11; 27.5%). Participants verbally consented to participate and to be recorded at the beginning of each interview. Interviews were recorded and transcribed. All participants were assigned pseudonyms, which were employed for transcription, analysis, and reporting here. Transcripts were checked and coded by one member of the study team (G.F.W.B.R.), while a second member of the team (L.S.S.) coded 25% of the transcripts to ensure that the team explored a range of competing possible interpretations.¹⁸ Any discrepancies were resolved by the members of the study team who reached conceptual agreement on the themes embedded in the data. We used QSR International’s NVivo software, versions 8 and 10 (Doncaster, Australia).

We began coding with deductively derived codes, based on the Rubio model,¹⁶ adding to these codes inductively as themes emerged. We used memos to develop data interpretation and consulted the relevant literature to help us refine our understanding of inductively emerging theories. Coding and analysis began while the interview process was in progress, allowing the interviewer to solicit further information from subsequent participants about emerging themes, when relevant. We engaged in member checks¹⁹ by sending participants drafts of this paper and asking them to comment on whether they felt that sections

particularly pertaining to their experiences were appropriately represented; we also offered them an opportunity to request or suggest changes to our interpretation, analysis, and reporting of their particular experiences or quotations.

Results

Participants

Nine institutions agreed to participate (see Table 1). The tenth was conducting its own interviews to evaluate its KL2 program at that time and did not want to burden KL2 alumni. Forty eligible KL2 alumni volunteered to participate from the nine institutions, with equal representation by men and women. Twenty (50.0%; 10 men, 10 women) had successfully transitioned to independent funding. Participants were predominantly non-Hispanic and white (see Table 2) and all worked at academic institutions. Sixteen (40.0%) were associate professors, while the remainder were assistant professors (see Table 2). Participants represented a wide range of disciplines, including medical specialties, surgical sub-specialties, psychology and psychiatry, social work, and non-medical health science and clinical fields.

Personal factors

The personal factors identified by participants as important for a successful transition from mentored research to independent funding were: (1) networks, (2) persistence and resilience, (3) initiative, (4) autonomy, and (5) personal and professional balance. Participants noted that the absence of one of these factors had a detrimental impact on their careers.

Networks—Many participants noted that relationships are a vital part of research and thus they prioritized the intentional development of interpersonal skills:

There's a very human part to what we do. It's not just science... You need to be able to network, you need to be able to talk to people, you need to work with them. I increasingly feel that these soft factors are just as important, if not more important, than your technical ability. (Charles, IF)

Participants described how having the right research team, both locally and nationally, can lead to career enjoyment and productivity, and many even said that developing a network was one of the most enjoyable aspects of conducting research.

IF participants revealed that they had been proactive about building their research networks locally, nationally, and internationally:

The other part that I think is important and that has to be done very strategically is networking with people at national meetings, and being willing to go to these meetings and really investing in that time, saying, "I want to come out of this meeting with four or five people that know me, that know what I work on, that can associate my name with a field of study. And if I can do that, they are now folks that I can link arms with." (William, IF)

Being part of a group of faculty with related but distinct research interests was instrumental to some participants because everyone in the group collaborated. Inclusion in such a group

offered intellectual, emotional, and financial support to all involved. A good network was particularly important for NIF participants who were engaged in research in a collaborative role. Strong local and national connections enabled these participants to continue their research endeavors. Feeling connected to one's colleagues also helped to fuel resilience and persistence, in addition to unveiling new research opportunities and making work more enjoyable. Hearing from IF colleagues or others who had navigated similar challenges helped provide participants with the impetus to continue through what they perceived as a struggle.

NIF participants frequently described how a poor or limited network hampered their research progress. Without a network, research can become isolating and unproductive: "People aren't successful on their own" (Tabitha, NIF) and "Part of the struggle...is that I'm the only person doing this here" (Rebecca, NIF). Some participants had no local colleagues doing similar research and noted the negative effect this had on their productivity.

Persistence and resilience—Participants, both IF and NIF, displayed strong resilience to the multiple challenges of conducting research and dogged persistence to continue in their research endeavors. Some participants recognized resilience as a personality trait, but most saw it as a learned skill, modeled for them by parents, colleagues, and mentors:

I had to learn to have tough skin and be persistent. I mean, everybody has to learn that, but we see so many people who just crumble at the critiques at some point. And I have so many rejections. The conventional wisdom would be that I should be out by now, that I should have been out a while ago. (Olivia, IF)

To maintain resilience and persist in their careers, participants recognized incremental rewards other than the final publication or notice of grant award. These rewards could be small steps along the path to achieving their main goal or the realization of improved research results after having one's initial beliefs or directions proved incorrect or suboptimal.

The participants who spoke most clearly about resilience and persistence were all IF. While all participants articulated the importance of these attributes and felt they possessed them, a few articulated a lack of motivation in their career that could erode persistence and resilience. Most framed the need for persistence and resilience in a positive light, while still finding it an unfortunate reality of conducting biomedical research. A minority, however, were more critical of this need. Robert (IF), who was well funded, expressed how the pressure to persevere led to feelings of burnout, especially since the rewards of working hard often led to being assigned even more "research-related responsibilities and service-related tasks," rather than being able to pursue his own, more intrinsically rewarding, research. He also questioned the work's effect on his home life and whether the reward was worth the effort of persisting:

[Research requires] a tremendous amount of self-sacrifice. It's a blurring of personal and professional lines that is in the order of completely unreasonable and not sustainable to achieve the goals that are asked of us...You miss out on life a lot.

So you give up a lot to do this. And then you start reflecting, “What the hell am I doing?”

Initiative—Many IF participants had taken the initiative to control and drive their career. They were intentional and “somewhat assertive” (Diana, IF) in reaching out for help from colleagues and experts with whom they had no prior relationship. In general, successful participants felt that the onus to succeed rested with them and that they needed to engineer their success. For example, Adam (IF) noted: “You just need to be attentive for opportunities and seize them when they show up.”

Some participants had taken specific, and sometimes unconventional, measures to ensure their success. Caroline (IF), who had successfully established a population that was willing, even eager, to participate in her clinical research, had spent a substantial amount of time talking to community groups about her work and its health implications. Despite the large amount of time involved, she was driven to do it because of an uncompromising desire to succeed: “I knew that this is what I wanted to do, and I knew to accomplish this I was going to have to do something different.”

Autonomy—Feeling autonomous in multiple realms was important for career success and satisfaction. Autonomy enabled participants to take ownership of their work, choose what they worked on, and decline to participate in projects that would not benefit their career. Autonomy also allowed participants to organize their work schedule and environment to best meet their needs and enhance their productivity.

Participants viewed a faculty position with research responsibilities as inherently autonomous: “I think the thing that still motivates [me] is the fact that I can study new things, the intellectual freedom that is associated with this type of career” (Simon, IF). Some participants had been advised by colleagues and mentors to decline projects or invitations for specific types of work and service. Doing so allowed them to control the work they could perform well: “I say yes to projects that are thematically related to my interests. Every project I work on, including training and clinical work, is related to [my field]. That makes it feel more manageable because I’m not scattered. I don’t work on other things” (Nicholas, IF).

Working from home afforded participants quiet time to think and write without the distractions of the institutional environment. Quinn (IF) described exerting her autonomy in this regard: “A couple of years ago, I started working from home a lot more, and that has helped tremendously. It doesn’t always work, but I try to...[maintain a] writing day.” In addition, working from home allowed parents to be present for their children without jeopardizing their productivity:

The wonderful thing about research is that it’s a bit flexible. And so it is really good for when you have little kids because if you need to miss something in the morning, you can make it up at night. (Georgia, IF)

Clinicians who enjoyed predictable service schedules could limit their clinical service to periods when their research demanded less of their time so they could focus on their patients without feeling a professional imbalance.

A lack of autonomy appeared to be the primary hindrance to securing independent funding for some NIF participants. Victoria (NIF), a methodologist, had limited autonomy because she was in more of a support role and because her husband's career affected some of her professional decisions. Polly (NIF) and David (NIF) lacked the autonomy to organize sufficient time for research since they both had limited funding and considerable clinical demands. David was unhappy that he was not afforded any "time to think" during the work day. For Polly, the lack of autonomy manifested in fewer choices about what she worked on; being a co-investigator made it more difficult to maintain her own research focus.

Many participants agreed that the level of autonomy granted to an investigator must be appropriate to her or his career stage and abilities. Jack (IF) cautioned:

It's a balance between guidance and autonomy when people are junior...and it's a difficult balance to titrate. I would say it has worked out well for me, but [autonomy] hasn't been a universal panacea for every career for every junior person.

Xander (NIF) had experienced an unusual amount of autonomy while he was a junior faculty member, having few senior investigators to guide him. While he viewed the freedom to engage in professional exploration positively, he also partially attributed his lack of success to it. Lacking direction and mentorship early on meant that he had no formal socialization into academic norms, which hindered his progress.

Personal and professional balance—Participants had varying views about balancing their personal life and professional work, regardless of their personal obligations (e.g., children and eldercare). A majority ($n = 25$; 62.5%) felt that they lacked, or struggled to find, work-life balance. Some participants adopted one or more approaches to viewing and achieving this balance, having seen these strategies employed by their colleagues or mentors. Doing so helped them feel content with how they divided their time between personal and professional activities. One such approach was to seek longer-term balance, dedicating appropriate amounts of time to their different roles over an extended period rather than judging balance on a daily basis:

There's some subconscious assessment on a daily/weekly/monthly basis: do I think that I've met the quota that I wanted to meet for [hobby], or doing research, or spending time with my kids? I was just at a meeting and the two weeks before that I had been on clinical service, so the bowl for my children was a little empty. So the kids and I are going camping this weekend. That will fill up that bowl, and I'll say, "Well, I probably need to focus on the research." It's this constant balance of as the water evaporates down, fill it back up like that. (Greg, IF)

A second approach was to reject the expectation of work-life balance and accept that creating any balance, at times, would be extremely challenging:

The quest for balance is...both a moot and futile quest, because there is no perfect balance point that one achieves and maintains. It's an ongoing process. When you recognize that [it is] a pendulum swinging, you are constantly thinking about what the most important pieces coming in. "If I do this then what? And what things are most important right now, in the short-term and in the long-term?"...If you think about that, you know that it's a constant juggle, I think it helps to make one not feel overwhelmed. (Tabitha, NIF)

Organizational factors

Participants identified three organizational factors that facilitated the transition to independent funding: (1) mentors, particularly those who were generous with their time, advice, networks, and resources, and who role modeled the kind of career the participant wished to pursue; (2) protected time for research; and (3) institutional resources and support, such as a strong community of investigators, good research facilities, a supportive infrastructure for research, ample patient populations, and encouragement to delegate.

Mentors—Both IF and NIF participants identified mentorship as a critical factor in participants' careers. Of the 40 participants, 36 (90.0%) mentioned mentorship or their mentors when asked who or what had been instrumental to their careers. However, the nature and definition of mentorship varied. Belinda (IF) was one of the four participants who did not mention mentorship. While most participants identified one or two mentors at different points in their career, Belinda rejected the idea of a single mentor providing all-encompassing support. Instead, she described how clinical and translational investigators need five different types of mentors: (1) a scientific, or content, mentor who provides discipline-specific training and scientific guidance; (2) a career mentor who provides advice regarding the mentee's career strategy and choices; (3) what she termed a "vent mentor," a confidante who listens to the mentee's professional troubles and provides an emotional outlet while maintaining confidentiality; (4) an impartial politically removed mentor, best fulfilled by a senior faculty member from a different department within the mentee's institution; and (5) a peer mentor role model, who is someone the mentee aspires to be like but with whom he or she is not professionally connected. This peer mentor role model does not provide active mentorship, and may not even know that he or she fulfills this role. However, his or her actions serve as a guide, when appropriate. Other participants also described having multiple types of mentors.

Participants stated that the most helpful mentors established a trusting relationship and met specific needs, such as giving advice, providing resources, making their network of relevant investigators accessible, role modeling a successful career, and being generous with their time, particularly during the early stages of research development or just before a grant submission. Helpful advice from a mentor was not limited to scientific guidance or career strategy. It encompassed navigating institutional and local politics, finding an optimal balance between the demands of one's personal life and work, securing the support of others when needed, and many other personal and professional issues. Several participants commented that seeking advice on the same issue from multiple mentors in different departments or disciplines was helpful as it provided divergent perspectives. Assimilating

these perspectives and contextualizing them to one's circumstances allowed participants to reach what they considered optimal solutions.

Mentors provided different types of resources. For many participants, mentors provided vital financial resources for early research projects: "In residency, [my mentor] paid for my research. He gave me a lab bench, and he has been extraordinarily supportive since then" (Jack, IF). Some mentors guided participants to funding sources other than the highly competitive NIH. For other participants, access to particular technologies and/or study subject populations was a direct benefit of mentoring relationships:

[My mentors helped me] practically, by giving me access to subjects. The first studies that I did on the KL2 were things that we appended to the batteries being administered to people already coming through...So having people who had more resources than I did who let me benefit from them, that was very helpful.

(Lawrence, IF)

Just as participants valued building their own networks, they appreciated access to their mentors' networks and guidance regarding how best to use this social capital to advance their careers:

Good mentors are very generous with their own connections. Good mentors say, "I know so-and-so and they have this expertise. You should go talk to them," and they help facilitate those connections. So throughout my career I have been fortunate to have those people who really helped advocate for me. (Helen, IF)

Mentors, as leaders in their fields, frequently are asked to participate in discipline-specific societies, meetings, study sections, or other opportunities. Often, mentors put forward their mentees for these opportunities instead of taking them for themselves, thereby propelling their mentees into their networks.

In addition, many mentors role modeled clinical and translational research careers. Given the different ways that faculty focus their research, service, teaching, and clinical care efforts, participants appreciated examples of successful careers and practical demonstrations of the impact career choices can have on one's professional and personal lives:

One way [mentors help me] is modeling, seeing people who are managing their careers in ways I would like to emulate. That means scientifically and intellectually, but also in terms of work-life balance and in terms of research/clinical/educational/administrative balance...I enjoy having a bunch of different people, none of whom are doing exactly what I want to do or is exactly what I want to be, but all provide pieces of it. (Jack, IF)

Participants also benefitted from observing specific professionally relevant skills that are less frequently taught in a formal setting, such as collaboration techniques and team work, acceptance of criticism, project management, and strategies to balance diverse work and personal demands.

One third of NIF participants credited their lack of a transition to independent funding partly to difficulties with their mentors; four experienced particular barriers, while the others had

mentors who simply were not as helpful as they might have been. Melanie (NIF) experienced a punitive relationship with her mentor, who was also her direct supervisor. In addition to unreasonable expectations when a family member was ill, he removed her from publications and grants to which she had measurably contributed and isolated her socially within the department. Elaine's (NIF) mentor had a "challenging personality," but she was the only local mentor in Elaine's field. Ultimately, Elaine said, "She was not at all interested in my research. She was more interested in my work in her lab, which didn't cost her anything." As a result, Elaine struggled to make progress. When she sought access to her mentor's network and additional support, she was told, "This is hard work; you'll have to do it yourself." Julia (NIF) was working with a mentor productively for a year when he abruptly stopped responding to her about a manuscript from their project. The mentor retained the data from the project and was unwilling to share them with her, despite the best efforts of senior colleagues to intervene. This caused a notable delay in her progress because she had to establish a new research project and build a new mentoring team. Yvonne's (NIF) primary mentor left the institution during Yvonne's first year on faculty, and she and her replacement mentor were not a good fit. Yvonne eventually found a mentor with whom she worked well but whose content area was not the best match for her work, which produced some challenges in terms of content advice and networking.

Protected time for research—Many participants noted that the 75% protected time for research and research training provided by their KL2 award was critical to developing their research: "Having protected time to learn and write [has been instrumental to my career]... Every task that I have spent time on has been related to moving my research forward" (Diana, IF). It allowed them to be productive and establish themselves in their fields, develop relationships with mentors and colleagues, and plan a strategic research agenda. However, KL2 awards vary in length by institution. Participants in two-year programs commented that, while the protected time was helpful, two years were insufficient to allow for substantive development of their research, making it difficult to submit an R01 application in that timeframe.

A few participants encountered problems receiving or maintaining the 75% protected time for research funded by their K award. This hindered their ability to develop their research project sufficiently to secure independent funding. Tabitha (NIF) was assigned clinical duties that amounted to 65% effort while she was on a KL2 award, and she was unable to secure political support to remedy this situation. Rebecca's (NIF) K award protected 75% of her time for two years, with the understanding that her department would provide a third year of financial support at this level. However, the department required her to be a co-investigator on others' grants in the third year to support her time, obligating her to contribute to their research rather than pursue her own.

Institutional resources and support—Participants mentioned four institutional resources that they viewed as important to their career success: (1) a strong community of investigators, (2) good research facilities with logistical support, (3) ample study subjects in relevant patient populations, and (4) the ability to delegate. Participants appreciated all these institutional resources more or less equally.

A strong community of investigators allowed participants to obtain feedback on their ideas from experts, and importantly, provided them with multiple collaborative opportunities, which expanded their research network, broadened their areas of expertise, provided different research experiences, increased their number of publications, and provided salary support as a co-investigator. Collaborations also accelerated participants' research, as many of the necessary infrastructure pieces and resources specific to their field were already in place. In addition to building and fostering networks in particular fields, participants especially appreciated institutions that intentionally built and propagated a highly collaborative culture.

Senior faculty and leaders who understood the demands of research were seen as highly supportive of research careers and instrumental in fostering communities of related investigators. These senior individuals provided professional emotional support and guidance and, frequently, tangible resources to help junior faculty surmount challenges. Joe's (NIF) new division chief was a clinical investigator who brought to the fore many extant resources, such as help with institutional review board protocols and collaboration facilitation, of which Joe, as a newly hired faculty member, had been previously unaware.

Both IF and NIF participants appreciated access to specific research infrastructure, physical facilities, and logistical support. This included educational curricula in clinical and translational research; clinical and translational science degree programs; pilot funding; statistical support; help with proposal and manuscript development and editing; mock study sections; leadership training and other professional development opportunities; help with preparing institutional review board protocols; administrative support; professional grants management support; and access to a clinical and translational research center or other units available for research participant visits. Many of these services were available either through KL2 programs or a CTSA. Others, however, existed because of the vision and support of a division or department chair who provided research infrastructure and support for his or her faculty.

Access to patient populations relevant to their specific research agendas provided faculty with a steady supply of study participants with specific diseases or attributes. Institutions with a large, well-known clinical expertise in a particular area tend to attract patients with illnesses or other health problems related to that field. They also often have other studies in place, including clinical trials, to which junior faculty may be able to add a small study or from which they may be able to obtain secondary data to analyze. William (IF) illustrated this characteristic of his institution:

[Our institution] has a pretty sizable contract from NIH, and it allows us to do a lot of different trials. Our portfolio is so broad that we can do a lot of side projects as well. So I get to do [one] study and then say, "Well I could do those same techniques on [another] study."

These resources provide an efficient way to build a publication record, establish oneself in the field, and develop new research ideas.

The final manner in which institutions supported participants was by providing staff to whom tasks could be delegated and/or helping faculty learn to delegate. Some participants had a staff member who “manages everything” (Greg, IF) in their research group. Others had excellent access to research or administrative professionals:

All of those folks do the day-to-day and without them, I don’t know what we would do, because they are instrumental. And then I have an amazing laboratory manager and a couple of junior faculty members whom I am mentoring that run the laboratory. So [I feel like] a conductor making sure that all of the positioned players are just knocking it out. I can help where I need to, but some things are on autopilot. (William, IF)

Delegation was not easy for some participants, however. They needed help to work out to whom and how to delegate specific work. Some participants were just learning to delegate or it was something to which they aspired: “I could be better at having people with other skillsets do things for me. Sometimes I am uncomfortable asking other people to do that even though it may be part of their job description” (Edward, NIF). Being surrounded by a competent team to which they could delegate, often provided by the institution, greatly facilitated participants’ comfort in assigning tasks.

A lack of institutional resources presented obstacles for a few participants. Felix (NIF) and Edward (NIF) moved institutions and were confronted by the relative lack of research infrastructure to support their work at their new institutions. Paul’s (NIF) workplace was not near most of his institution’s research infrastructure. Although his dean was very supportive of his research efforts, he had a limited number of senior colleagues in his field nearby.

Most NIF participants lacked one or more of the beneficial personal or organizational factors described above. Some could not identify a specific barrier but felt that they needed more time to secure their funding, which could be interpreted as a lack of initiative, a lack of protected time, a lack of effective mentoring, or the absence of a comprehensive panoply of helpful factors. A minority of NIF participants, however, attributed their current lack of independent funding to an unusual series of personal or family issues. These unforeseeable and unavoidable circumstances demanded their time and energy, and prevented them from focusing on their work for a while, or necessitated relocation, which was disruptive to their careers. In these cases, NIF participants felt that, with additional time and support, they would be able to secure independent funding.

Supplemental Digital Tables 1–2, available at [LWW INSERT URL], present additional representative quotations regarding the personal and organizational factors that facilitated participants’ transition to independent funding.

Mid-career challenges and reconceptualizing success

Three themes emerged that brought into question the meaning of success for clinical and translational science investigators: (1) lack of confidence and clarity about one’s career; (2) broader definitions of success; (3) a broad spectrum of successful career paths.

Lack of confidence and clarity about one's career—Although the personal and organizational factors outlined above contributed to participants' career success, a number of IF participants who exhibited or had benefited from these factors continued to face challenges. Just over half (n = 11; 55.0%) of IF participants expressed either a lack of confidence or a lack of clarity about their future career paths.

Louisa (IF) commented in detail on the lack of a “steering wheel” to guide associate professors through their mid-career years. This sentiment was echoed by others: “What is the end game? Because it's not necessarily your first R01, but it's where to take it” (Caroline, IF). Participants appreciated the relatively straightforward career path delineated during their early-career years when they were guided by their KL2 mentors to secure independent funding. However, once that goal was achieved, and particularly after they had been promoted to associate professor, they felt there was little guidance on the steps necessary to continue to be successful and that such guidance would be helpful:

[Career path planning] seemed so much clearer during the K program, maybe because there's so much more intention and support around it...[It would be helpful] to have those processes [about] career plans and...milestones, in the same way that you did on the K program. It's made me question a lot the feasibility of a research career and whether it's really going to work out. (Georgia, IF)

While this lack of career guidance was a challenge to some, a number of participants saw it as an opportunity, or at least as a juncture that called for strategic deliberation. Several participants stated that they had been intentionally considering their next career steps, trying to decide which of multiple paths they would pursue:

[My career direction is] something I've been thinking actively about since promotion. I know what I am doing now. I know what I want to do over the next few years, which is what I'm doing now, just better. But I really don't know what I'm going to be doing in 10 or 15 years. Obviously it's going to be in [broad field], but I don't know if I want to carve out time to devote to write popular books or if I want to keep doing what I'm doing and not really much more, or if I want to take on a greater leadership role. (Jack, IF)

Participants who did not articulate a focused plan to continue a particular line of research were pondering a variety of potential positions, including in different areas of research, clinical care, educational leadership, administration, and health care leadership beyond academia. Some perceived a need to change institutions to pursue the opportunities they envisaged or to realize their full potential:

Some of my colleagues, people who have been helpful mentors to me in the past, have begun to see me as competition in a way, or potentially occupying space that they would rather occupy themselves. I like it here. I would like to stay here, but I don't know if to continue to succeed I would have to leave. (Lawrence, IF)

Even IF participants with a clearly delineated career path expressed a lack of confidence in their ability to continue securing funding. They agreed that one R01 was insufficient to support their research agenda but were unsure whether it was feasible to secure multiple grants. They saw their senior colleagues and mentors struggling, and they felt funding

decisions could be arbitrary, which led them to question whether they could have successful, independently funded research careers long-term:

I'm not sure if I can maintain my career with NIH funding...It's discouraging when I see senior people having these difficulties. How am I going to be able to accomplish that when my mentors also have these difficulties? How do I compete with them when they are so far along and are themselves discouraged about the payline and how difficult it is? So of course I want to continue my research program, but it all depends on if I am supported financially to do that. Otherwise I am not certain what will happen. (Diana, IF)

Broader definitions of success—Many participants who had less clarity regarding their future career path defined success in terms other than the extrinsic grant and publication measures often employed by academic medical centers. Instead, they identified intrinsic metrics:

Helping all these people is what interests me. Not, "I wrote 70 papers, had two R01s and all these foundational grants and this and that." That to me is a CV, it's a piece of paper, it's nice, but I don't know what it gets you at the end of the day. I want a more meaningful change. (Robert, IF)

However, these participants acknowledged that working at institutions that used extrinsic measures necessitated meeting these goals, even when doing so did not match their own professional values or personal definition of success. To varying degrees, participants felt this tension and found it frustrating. All participants who described this tension, however, understood that these extrinsic measures were what would allow them to continue in research; without funding, they would not be able to support their work:

If I don't meet some of the university's goals, I can't achieve my personal goals. I wish I could think more that the university's goals are [mine] and I need to get those, but that's the problem. I can't. My goals are not materially based. And so I find myself constantly knowing that I have to achieve their goals to achieve my goals [of conducting my research]. (Louisa, IF)

Many participants judged their success using a variety of intrinsic metrics (see Supplemental Digital Table 3 at [LWW INSERT URL]). Belinda (IF) specifically mentioned that, as a result of her research, her team is "saving lives," and so she considered herself successful. For others, success meant seeing their research translated into the practice and policy arenas. Both IF and NIF participants also offered other measurable extrinsic definitions of success, including: being recognized by others for one's achievements; being given more responsibility; being asked to collaborate or to be a mentor; being invited to give talks; being asked to participate on national committees; and being awarded prizes, promotions, and tenure. Some participants felt that even the extrinsic institutional measures of success, such as grants and publications, were intrinsically rewarding after the significant amount of work required to write a grant or publish a manuscript.

Some participants' definition of success rested mainly on their career enjoyment and satisfaction. Having fun in their work, seeing themselves as privileged to do what they

wanted, interacting with interesting people, and tackling engaging challenges were important, particularly for those participants who were either IF or who had pursued a career path that did not rely on independent funding. Seeing mentees succeed was also important, as it indicated that the participants had left a positive, lasting mark on the scientific community and that their mentoring efforts had been fruitful. Greg (IF) suggested that trainees' success and the frequency of being sought out by others for training and collaboration were metrics other than grants and publications that institutions could use to measure success. Finally, the ability to have a fulfilling professional life and to see, provide, and care for one's family was another definition of a successful career for both IF and NIF participants.

A broad spectrum of successful career paths—NIF participants demonstrated that career advancement did not rely solely on securing independent funding. Six NIF participants had been promoted to associate professor, and ten held other academic or national leadership positions, which were either clinical, educational, or within a research network, reflective of their respective value to their institutions or of their recognition by peers in their fields. These positions suggest that institutions and peers deemed them successful by measures other than research funding.

Nathan, Edward, Felix, Xander, and Mark (all NIF) had used their KL2 training to pursue career paths that did not rely on independent funding for success. These opportunities led them into leadership positions and were made possible only by the knowledge and local or national visibility they gained through their KL2 training. Their career paths prioritized research to different extents and serve as examples of successful academic medicine careers that are open to those who trained in research but that do not depend on independent funding.

For example, Nathan (NIF) was hired by another institution to develop its clinical research infrastructure and to serve as a mentor to its clinical research trainees. His career goals centered on improving patient care from a clinical, as well as research, standpoint. He therefore remained interested in conducting research and was glad to continue to be part of the research process. His new position came with 50% protected time for research, but the institution expected that he would use that time to develop the infrastructure of the clinical research program and mentor other investigators. Despite these institutional expectations, he continued to align his professional success with securing funding.

Edward (NIF) left a highly supportive environment at his KL2 institution to assume a leadership position developing a new hospital-based patient safety and quality program that was closely related to his research agenda. While he found the lack of pressure to secure funding and the autonomy of the position liberating, he acknowledged the need to secure a research grant soon, so that the period without funding on his CV did not harm his future research applications. Without the focus on research at his new institution, however, he reported struggling to secure adequate resources, such as statistical support.

Felix (NIF) was recruited to another institution to establish and lead a new clinical section. He saw his likely future involvement in research as mentoring junior investigators in his section or as a co-investigator on others' grants.

Xander (NIF) similarly prioritized mentorship and collaboration, in addition to securing grants as a PI. He entered his field when it was relatively new and lacked a distinct direction for a number of years, until he became involved with a national research network. He considered himself a steward for the field, guiding junior faculty to develop more structured career paths than had been available for him. He focused his research efforts on playing a collaborative and mentoring role, particularly as part of the national research network to which he belonged.

Mark (NIF) had originally intended to be a clinical investigator, pursuing an outcomes-based project focused on a disease area. However, he found himself gravitating toward teaching others how to navigate the world of clinical research and complete their own research. He chose a position that had a formal mandate to educate students and residents, so he received salary support to do so. His main enjoyment in conducting research came from working with others, and he was able to do so as a mentor and collaborator, more so than if he were leading his own research projects. Ultimately, he saw himself equally as a clinician, an investigator, and an educator, devoting time to each role.

Discussion

This study, designed around the Rubio model of physician-scientist career success,¹⁶ revealed the personal and organizational factors that facilitate the transition to an independent clinical and translational research career. These factors include networks, persistence and resilience, initiative, autonomy, personal and professional balance, appropriate mentorship, protected time for research, and institutional resources and support.

Many of these factors are related, which may explain why the absence of any one can derail an individual's career. Junior faculty with an appropriate level of autonomy are more likely to carve out a career that is engaging and fulfilling for them, and to find an acceptable balance between their personal and professional obligations. Thus, they pursue a line of work for which they are highly motivated. Being motivated to engage in this type of work may drive an individual's initiative and fuel her or his persistence and resilience. Those who enjoy their work and/or are strongly motivated to find answers to specific research questions or to improve public health—all definitions of success used by participants in our study—may be more likely to act to enhance their likelihood of career success, persist in challenging circumstances, and be resilient to multiple setbacks. Faculty with strong initiative may be more likely to seek out and establish mentoring and collegial relationships with colleagues who can help them in their careers. They also are more likely to have extensive networks and to benefit from the many ways in which mentors can assist them. Having extensive networks and helpful mentors, in turn, can provide social support and role modeling for junior faculty, which may further enhance their resilience and foster perseverance. With these personal factors in place, participants were better positioned to succeed, as long as they also had access to the appropriate institutional resources. A long-

established theory of career motivation posits that resilience, autonomy, and initiative (“situations in which outcomes are contingent on their behavior”) tend to go together with career motivation,²⁰ supporting our findings of the interrelatedness of these factors.

While this interrelatedness is appealing if one has, or can develop, each factor, it is problematic for those who, for whatever reason, find themselves lacking in one particular area. Without a strong drive to establish oneself as a PI, junior faculty may struggle to arrange sufficient autonomy over their work, instead working to support others’ research. They then are more dependent on their mentors as supervisors. If their mentors are not supportive, the individual may find it difficult to become independent.

Of all the organizational factors, mentoring emerged as the most important. Unsupportive mentors—whether due to lack of time, availability, interest, or desire to help—affected some NIF participants’ lack of funding. Mentors who did not have the appropriate content knowledge or networks either did not engage in the mentoring relationship or behaved in a bullying manner. Either way, they were detrimental to their mentees’ careers. Conversely, many IF participants credited their success to their mentors.

Mentoring in academic medicine has been studied extensively. A 2006 systematic review found that mentors played an important role in academic medical careers, including providing career guidance, which encompasses the advice and role-modeling found in this study, and fostering research productivity.²¹ Mentors also helped junior investigators by providing resources, and investigators with research mentors had more time for research,²¹ in line with our finding that protected time for research was crucial for securing independent funding. A 2010 systematic review found that mentors should be well-established in their academic community,²² which further affirms our finding of the benefit of having access to a mentor’s network. This finding is partly in contrast to the opinions of KL2 program directors, who did not value as highly as our participants both the initiative junior faculty showed in seeking the advice of colleagues and the importance of having research interests that meshed with institutional strengths.²³

Other findings from our study regarding mentorship reflect those findings reported in the literature. For example, one study reported that mentoring was the first or second most influential factor hindering career progress in academic medicine,²⁴ while another found that mentoring significantly reduced the time to promotion in academic medicine.²⁵ Role modeling by mentors has only recently been fully acknowledged in the literature as improving career outcomes.²⁶ Finally, DeCastro and colleagues²⁷ determined that it was highly improbable for one individual to fulfill all the needs of a junior investigator, supporting the need for multiple mentors.

NIH has recognized the importance of protected time in research careers, requiring and providing 75% (50% for surgeons) protected time for research and training for career development awardees. All participants in our study had at least two years of this support through a KL2 award; some had received as many as five years of support. Some NIF participants reported that their time was not properly protected during their KL2 award. Their inability to focus on their research had a negative effect on their productivity and

transition to independent funding. Other NIF participants reported that only two years of support was insufficient to establish their research agenda and that they would have benefitted from at least another year of funding. Some IF participants, conversely, described their tactic of focusing only on their research topic, even in their clinical, administrative, educational, and service work. They organized their unprotected time to support and advance their research agendas. Research has shown that protected time is critical to faculty job satisfaction²⁸ and physicians' publication rates.²⁹ These findings also suggest the need for alternative mechanisms to protect early-career investigators from the demands of clinical responsibilities during a critical period of their research career development.

Our findings underscore the benefit cross-disciplinary research resources can have on early-career faculty, suggesting that resources should continue to be allocated in this way. NIF participants who moved from resource-rich institutions to those with less infrastructure experienced difficulty re-establishing their research and finding the support or facilities to perform their work and transition to independent funding. The NIH's recognition of the importance of such resources to streamline the process and enhance the timeline for translational discovery was a fundamental tenet underlying the creation of the CTSA program.³⁰

Our findings provide insight into our emerging understanding of what is meant by success for clinical and translational investigators, particularly KL2 awardees. We uncovered the ways by which participants judged their own success, beyond grants and publications. These definitions of success were both intrinsically motivated, such as improving health and health care, enjoying one's work, and seeing trainees succeed, and extrinsically motivated, such as receiving external validation and recognition for one's accomplishments and providing for one's family. Our study also characterized the elements of successful career paths that extended beyond being an R01-funded PI. Some participants held leadership positions that did not rely on independent funding; these individuals were recognized by their institutions as being successful because they had been appointed to these positions.

The cases of the NIF participants who were successful in other domains suggest that faculty leaders need to reconsider the goals and success metrics for career development awardees. Felix, Mark, and Xander all saw their future roles in research as collaborators rather than PIs. Other NIF participants also had substantial co-investigator support from others' grants while they pursued their own independent funding. An emerging area of importance in the CTSA community is understanding and developing team science to augment and accelerate scientific discoveries and their translation to human health care.³¹ Our findings support this increasing interest in team science and the wider array of faculty career paths it provides. Given the challenging funding climate and the increasing appreciation for the role of team science in the generation of new knowledge,¹³ questioning whether investigators must obtain independent funding to be considered successful is becoming more relevant. Instead, faculty may have a demonstrable role (including funded effort) on a team-based project, thus remaining in research without being a PI, as was the case for some NIF participants. Some institutions, such as the University of North Carolina at Chapel Hill School of Medicine,³² now recognize key team science roles and accomplishments as elements that support successful promotion and tenure applications. As research teams expand and the range of

disciplines collaborating on innovative projects increases, more investigators will participate on a team without having a leadership position. Expanding the available career paths may allow K awardees to make the best use of their training opportunities and protected time. In turn, they may be more productive and successful, whatever their chosen path, as they come off their career development award and transition to mid-career.

Participants also identified the challenges perceived by mid-career clinical and translational investigators who had transitioned to independent funding (i.e., are considered “successful”), which include the absence of: (1) established benchmarks and milestones as guideposts for developing one’s long-term research goals, (2) sustained guidance beyond the attainment of one’s first independently-funded grant, and (3) a supportive institutional culture to bolster one’s confidence to continue to compete successfully for grant funding. These challenges have received relatively little attention in the literature, but previous studies have arrived at similar findings to ours. Mid-career faculty frequently experience a transitional period during which their professional focus changes.³³ In one study, faculty in a variety of non-professional (i.e., excluding academic medicine, amongst others) disciplines reported having unclear goals, being uncertain about where to develop their niche, and feeling concerned about how to remain competitive, in addition to other challenges.³⁴ An opinion piece providing advice to mid-career faculty in academic medicine included substantive discussion of maintaining funding and mentioned “rejuvenation,” which may be akin to our finding regarding expanding one’s area of focus.³⁵ A study of mid-career women faculty in academic medicine found that establishing work-life balance and making important contributions to their field were central components of participants’ definitions of success,³⁶ further validating our findings.

Mid-career faculty may start to move away from the close mentoring relationships they enjoyed as junior faculty, becoming more equal colleagues and collaborators with their former mentors. Although advice from mentors remains important for faculty at all levels, the close monitoring of progress and regular meetings that are built into KL2 programs likely have disappeared by mid-career, as some participants who were further along in their careers reported. Mid-career faculty are more likely mentoring others. However, at this point in their careers, clinical and translational investigators likely could specifically benefit from career mentoring as they strategize about their long-term goals.³³

Implications

Our findings have implications for many groups, including career development awardees, mentors, division/department chairs who support junior faculty, and institutional leaders.

Personal factors—Investigators should develop and routinely practice the personal factors participants described. They should:

- Cultivate and use networking skills,
- Seek help to reframe negative experiences and rejections in ways that develop resilience and encourage perseverance,

- Be respectfully assertive in taking the initiative to develop their career and to secure the resources they need,
- Take ownership of their work to achieve a sense of autonomy,
- Arrive at an understanding of their personal and professional balance and continuously strive to maintain it,
- Assemble a team of available and dedicated mentors with significant career experience, wide networks, and appealing career paths, and ask those mentors to role model the behaviors that facilitate career success,
- Be persistent and vocal advocates for protected time and seek the support of mentors and institutional leaders in working toward that goal,
- Identify institutions with welcoming investigators in their discipline; relevant patient populations; comprehensive, pertinent, and available research facilities; and logistical support, and
- Seek help in learning to delegate and find people to whom to delegate.

Organizational factors—Many of the practical steps that institutions can take to facilitate junior faculty members' careers involve providing financial resources. We recognize that in the current resource-tight environment, the provision of additional resources may be challenging for institutions. However, resources spent on junior faculty may pay dividends as their careers develop. Institutions should:

- Require all associate and full professors to participate in effective mentor training and provide financial support for mentors,
- Offer assistance in arranging mentoring teams for junior faculty,
- Support broad interpretations of career success (beyond grants and publications),
- Appoint leaders who understand research careers and are sympathetic to their inherent challenges, and assess this trait in annual performance evaluations,
- Regularly ask junior faculty what they need to be successful and respond where possible,
- Protect faculty time,
- Offer courses and mentorship in how to delegate tasks and provide skilled administrative and support staff,
- Intentionally develop communities of investigators in specific fields and coordinate clinical recruitment to ensure investigators have access to multiple patients in the same fields,
- Promote a culture of collaboration—one that facilitates collaborative research,
- Include in tenure and promotion guidelines information about collaborative career paths and how to assess team scientists,
- Provide administrative and logistical support to establish team projects, and

- Give institutional leaders a mandate to propose collaborations and make introductions across the institution.

In addition, our findings suggest the need for discussion at the federal level regarding the indirect costs covered by NIH mid-career mentorship awards (i.e., K24). The substantial difference in what is covered by a K24 award and what is covered by an R01 award has meant that institutional leaders traditionally have valued mentoring awards less than research awards; therefore, faculty feel pressured to focus on their research rather than on mentoring others.

Limitations and future research

Our study depended on KL2 alumni volunteers and is therefore not representative of all investigators. Limiting our study to institutional career development awardees excluded the many investigators without these helpful awards. Thus, future studies could explore the factors that facilitated or hindered the progress of mid-career faculty who succeeded and persisted without the aid of a career development award.

Another notable limitation is the exclusion of individuals who left academia. These individuals may perceive themselves as having “failed” their program, and may be reticent to discuss this, even with the guarantee of anonymity. Future studies could solicit the opinions of KL2 alumni who left academic positions to determine what organizational or personal factors helped or hindered their careers and how they define career success. Such a qualitative study would complement quantitative studies conducted with a broader population of academic medicine faculty.³⁷ Similarly, these individuals could help identify the skillsets they acquired from mentored training that are most helpful in their chosen career paths.

Our study had an equal number of male and female participants in both funding groups, and we found no notable differences between the sexes. However, relatively few participants were racial or ethnic minorities. Since the career pipeline in academic medicine is particularly “leaky” for women and those from diverse backgrounds,^{1–3} future studies should focus on the personal factors that facilitate the transition to independent funding for those from diverse and underrepresented backgrounds.

Additional studies could investigate how particular facets of career success are built. For example, what steps should programs take to instill persistence and resilience in their trainees? What networking skills could help scholars be more proactive in building a research network? How do programs help mentors allocate appropriate levels of autonomy for each mentee? How do some institutions find resources to support early-career faculty? Future organizational studies could examine the fiscal feasibility of pursuing a career path when one is primarily a collaborator, rather than a PI, so that those who want to pursue this pathway have some guidance on how to support themselves without their efforts being diluted by too many diverse demands. Finally, further work is needed to understand how best to measure the success of training and career development program alumni, if not by publications and grants, so that programs can be effectively evaluated while still acknowledging a broad spectrum of successful career paths.

Conclusions

In this study, we examined the personal and organizational factors that facilitate junior investigators' transition to independent funding. We also extended our understanding of what it means to be successful in a clinical and translational research career. The factors we identified aligned with the building blocks in the Rubio model of physician-scientist career success.¹⁶ The psychosocial milieu and personality elements of the Rubio model are relevant to KL2 awardees trying to secure independent funding. In addition, the organizational factors in the Rubio model align with those that emerged in our study. Our findings regarding protected time are reflected in the organizational factors of the Rubio model, like "conflicting demands." The relational factors in the Rubio model include both mentoring and networking, the latter of which emerged as both a personal and organizational factor in our study—we found that individuals should focus on acquiring networking skills and being proactive in forming a network and that institutions should provide a collaborative culture and community of investigators. Awareness of these factors can help junior investigators be intentional about seeking the support, resources, and skills they need for a successful clinical and translational science career.

We also explored what it means to be successful. Our findings again support the Rubio model, with its extrinsic and intrinsic outcome components, but they also suggest the need to expand our definition of success for this population. The non-traditional career paths demonstrated by some participants showed how some components of extrinsic success, such as having a leadership position and being promoted, can be pursued in place of other components, like securing grants. Our findings also demonstrate the transient and relative nature of success; a faculty member who has secured independent funding may question her or his career goals a few years later. Understanding the nuances underlying various types of career success can help determine appropriate career paths, business models, and strategies for achieving goals that align with investigators' individual interests and skill sets in today's environment of funding challenges and the increasing importance of team science.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of the Nine Clinical and Translational Science Award-Funded Institutions Participating in a Study of the Factors that Facilitate Junior Investigators' Transition to Independent Funding, 2013–2014

Institution	Region	Governance	No. (% of 40) participants
Cleveland Clinic/Case Western Reserve	Midwest	Private	4 (10)
Columbia University	Northeast	Private	3 (8)
Johns Hopkins University	Southeast	Private	5 (13)
University of California, San Francisco	West	Public	4 (10)
University of Pittsburgh	Northeast	State-related	8 (20)
University of Texas Southwestern Medical Center	Southwest	Public	5 (13)
Vanderbilt University	Southeast	Private	3 (8)
Washington University in St. Louis	Midwest	Private	3 (8)
Yale University	Northeast	Private	5 (13)

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Table 2

Demographic Characteristics of the 40 Participants in a Study of the Factors that Facilitate Junior Investigators' Transition to Independent Funding, by Funding Status, 2013–2014

Characteristic	No. independently funded	No. not independently funded
Race		
White	16	12
Asian	3	4
African American	0	1
Does not wish to identify	1	3
Ethnicity		
Not Hispanic/Latino	17	16
Hispanic/Latino	2	2
Does not wish to identify	1	2
Academic rank		
Assistant professor	10	14
Associate professor	10	6

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