Published in final edited form as:
Acad Med. 2011 December ; 86(12): 1571–1576. doi:10.1097/ACM.0b013e31823592fd.

A Comprehensive Career-Success Model for Physician-Scientists

Doris M. Rubio, PhD,
professor of medicine, biostatistics, nursing, and clinical and translational science, the director of the Data Center at the Center for Research on Health Care (CRHC), and the co-director of the Institute for Clinical Research Education (ICRE), University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.

Brian A. Primack, MD, EdM, MS,
assistant professor of medicine and pediatrics, University of Pittsburgh, Pittsburgh School of Medicine, Pennsylvania.

Galen E. Switzer, PhD,
professor of medicine, psychiatry, and clinical and translational science, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.

Cindy L. Bryce, PhD,
associate professor of medicine, health policy and management, and clinical and translational science, University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pennsylvania.

Deborah L. Seltzer, and
research associate in the Department of Medicine and the director of research development at the CRHC and ICRE, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.

Wishwa N. Kapoor, MD, MPH
Falk Professor of Medicine, vice chair of the Department of Medicine, director of the CRHC and ICRE, and co-director of the Clinical and Translational Science Institute, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.

Abstract

With today's focus on the translation of basic science discoveries into clinical practice, the demand for physician-scientists is growing. Yet, physicians have always found it challenging to juggle the demands of clinical care with the time required to perform research. The Research on Careers Workgroup of the Institute for Clinical Research Education at the University of Pittsburgh developed a comprehensive model for career success that would address, and allow for the evaluation of, the personal factors, organizational factors, and their interplay that contribute to career success. With this model, leaders of training programs could identify early opportunities for intervening with potential physician-scientists to ensure career success. Through an iterative

Correspondence should be addressed to Dr. Rubio, Center for Research on Health Care, 200 Meyran Ave, Suite 200, Pittsburgh, PA 15213; telephone: (412) 692-2023; fax: (412) 246-6954; rubiodm@upmc.edu.

Other disclosures: None.

Ethical approval: Not applicable.

Disclaimer: The ideas expressed in this article are solely the views of the authors and do not necessarily represent the official views of the NCRR or NIH.

process described in this article, the authors identified and examined potential models for career success from the literature, added other elements determined to be significant, and developed a comprehensive model to assess factors associated with career success for physician-scientists. The authors also present examples of ways in which this model can be adapted and applied to specific situations to assess the effects of different factors on career success.

Concerns about the "endangered physician-scientist" are not new.[1–3] Physicians have always found it challenging to juggle the demands of clinical care with the time required to learn research skills and perform investigations. Many physicians have also found it challenging to obtain the protected time that they need to start and maintain a research program,[4] to deal with the long time lag between beginning a research career and receiving R01 or similar funding,[5] and to cope with the career uncertainties related to the reliance on federal and other grants for salary support.[5] For these reasons, many have not been attracted to a career that combines clinical work with research. However, with today's growing focus on the translation of basic science discoveries into clinical practice and the increased need for comparative effectiveness research, the demand for physician-scientists is likely to grow, as is the demand for new ideas and programs to increase the supply of physician-scientists.

In response to the many difficulties that physicians face when they attempt to pursue a research career, the National Institutes of Health (NIH) has established several supportive programs, including the NIH loan repayment program, career development awards, and the Clinical and Translational Science Award.[2] Similarly, universities have established various types of career development programs. While these programs are useful to young investigators,[6–8] they do not appear sufficient to substantially increase the cadre of well-trained physician-scientists, nor are they always successful in addressing the problems faced by specific groups of physicians who might be interested in pursuing investigative careers.

Studies indicate that women physicians, for example, are hindered by perceived gender bias,[9] a lack of role models in research,[10,11] difficulty finding mentors of the same sex,[11,12] perceived lack of institutional support,[13] and the challenges of raising a family while managing a research program.[13,14] For this population, issues related to work-life balance are particularly onerous and include problems related to scheduling meetings that do not conflict with previously planned child care responsibilities,[15] a lack of on-site or emergency child care,[13] a lack of lactation sites,[16] and a lack of promotion paths for part-time work.[13,17]

Like women, members of underrepresented minority groups report a dearth of role models in research.[3,18] Minorities also report discrimination at an institutional level[19,20] and insufficient efforts related to retention and promotion.[6,17,21] In addition, minorities describe difficulties in dealing with feelings of isolation,[19] financial burdens,[22] challenges associated with trying to balance a research career with the constant demand for their service on minority committees and their service as mentors for others in minority groups,[3] and lower levels of career satisfaction.[20]

To date, most studies of career development programs have tended to evaluate outcomes related to one or more specific program components. Various studies, for example, have demonstrated that mentoring has a positive impact on the career trajectories of physician-scientists, including those who are women and members of minority groups.[23–27] These studies have indicated that effective mentoring is associated with high research productivity,[28] increased professional socialization and interactions,[27] and greater satisfaction with salaries and promotions.[29,30] Moreover, a meta-analysis of results of mentoring studies has indicated that effective mentoring is associated with higher job

satisfaction, greater self-esteem, greater organizational commitment, greater perception of promotion opportunities, lower work stress, and lower levels of work-family conflict.[31]

At the University of Pittsburgh's Institute for Clinical Research Education (ICRE), which offers diverse training and career development programs in clinical and translational science for investigators throughout the pipeline, the career development programs include a mentoring component and numerous other successful training elements. However, we were interested in creating a comprehensive model for career success that would address multiple personal factors (e.g., demographics, education, and the psychosocial milieu) and organizational factors (e.g., financial resources, infrastructure, training, and mentoring) and would also take into account the complex and multifactorial interactions that occur between these personal and organizational factors. In addition, we were interested in creating a model that we could evaluate both in terms of the impact of its individual components and in terms of its overall impact on career success. Here, we describe the steps involved in developing and implementing such a model and establishing methods to evaluate its outcomes.

Our Approach to Developing a Comprehensive Model for Career Success

Consensus development

In 2007, the ICRE recruited faculty members from the various schools of the health sciences at the University of Pittsburgh to form the Research on Careers Workgroup with the purpose of developing a model and metrics for career success. Membership in the workgroup evolved by word of mouth, and anyone who expressed interest was invited to participate. Our initial group included faculty from the schools of medicine, pharmacy, pharmacology, and pediatrics and expanded to public health as well. One of the workgroup's first agenda items was to identify the factors that are related to career success so that we could develop interventions focused on these factors.

Borrowing from the literature of various disciplines, such as business and psychology, we created a comprehensive list of factors that contribute to career success. To better understand these factors, we also informally searched the literature for career-success models. As a group, we reviewed these models to determine the appropriateness of each for physician-scientists. Although we found several models,[32–39] we were unable to find one that was comprehensive and flexible enough to be applied successfully to both sexes and to different races and ethnicities. Because we were unable to find a model to fit our needs, over the course of the next two years, we created our own model for career success focused on training physician-scientists. A variety of institutions focused on training physician-scientists can use this model.

Building our own model for career success

In developing our comprehensive model for career success (see Figure 1), we aimed to characterize the associations between career success and the determinants of success at the most basic level. We met monthly as a team to engage in an iterative process of model development. Through an informal process, members of the workgroup searched the literature from various fields, including medicine, business, psychology, and vocational science to inform our model. As a group, we then selected, from this pool, several models with potential relevance to our population of interest—physician-scientists. We broadly examined these models for overlapping and complementary constructs, paying special attention to collapsing or expanding different constructs as they might be relevant to physician-scientists. For example, we decided to combine the constructs of networking and connectedness into networking and expand the construct of satisfaction to job and career satisfaction. Finally, we focused on each resulting construct (e.g., "career success," "relational factors," "conflicting demands" etc.), clarifying the meaning and scope of each

construct to assess its relationship to the other elements of the model. A more thorough description of this process follows.

Domains of career success—In reviewing the literature, we found that career success is almost always divided into two domains. These domains may be referred to as objective versus subjective career success,[32–39] extrinsic versus intrinsic job success,[37,40] or material versus psychological elements of success.[35] In each case, the first domain includes concrete or tangible markers of success, such as financial reward and hierarchical status, and the second includes abstract or intangible markers, such as personal and social fulfillment.[33,35,38] Based on prior theoretical and empirical work, we considered each of these aspects of the broader concept of career success to be highly relevant to physician-scientists.[32,41–44]

Interestingly, model developers place these two domains of career success in different locations within their models. Judge and colleagues,[39] for example, place subjective career success as the ultimate goal in their model, with objective career success as a mediator between determinants and that goal. However, most other model developers position objective and subjective career success as equivalent outcomes.[34,45,46] In our comprehensive model for career success, we used the domains of "extrinsic career success" and "intrinsic career success," and we followed the latter approach of viewing these as equally important outcomes. We considered markers of extrinsic success to be financial success, promotion, leadership positions, grants, and publications. We considered markers of intrinsic success to be job satisfaction, career satisfaction, and life satisfaction.

Determinants of career success—Although our literature review revealed myriad potential determinants of extrinsic and intrinsic career success, these determinants can be broadly classified as related either to the individual (personal factors) or to the institution (organizational factors).

We included the following personal determinants of success in our model—demographics, the psychosocial milieu, education, and personality—which were primarily informed by the literature. For example, first, according to the literature, important demographic factors to include when modeling career success are age, race/ethnicity, gender, socioeconomic status, and family composition,[32,43,47–49] so we added these to our model. We also added related but distinct psychosocial factors that may influence career success, including life events (both positive, such as marriage and the birth of a child, and negative, such as divorce and the death of a close family member), burnout, family stress, and care of dependents.[32,37,38,50] Several models in the literature emphasized education, training, or other means for preparation of the individual.[33,34,43,49] In our model, we sought to emphasize not only the general educational history but also the specific degree or degrees obtained (e.g., MD, PhD, or MD/PhD) and research experience that may not be represented by degree-related work. Finally, examples in the literature universally considered personality factors to be important individual determinants of career success.[42,51–55] Many of these studies[42,51–55] focused on the qualities that were found and measured by Amabile and colleagues in their Work Preference Inventory, including factors such as motivation, challenge, enjoyment, outward orientation, and compensation orientation.[56] In our model, we included motivation, creativity, passion, interest, leadership, self-efficacy, and professionalism.

Various models from the literature identified a number of institutional resources that influence career success.[33,34,36,41,43,57] First, in our model, we included important organizational factors, such as the institution's financial resources as well as its infrastructure and overarching support of research. Next, we included training opportunities

provided by the institution, such as didactic programs and hands-on research experiences. Then, because models from the literature also emphasized the importance of mentoring and networking,[37,54,58–60] we created a category called "relational factors." Finally, we added a category called "conflicting demands", because studies from the literature frequently referred to the challenge that physician-scientists face in balancing their research with their clinical and service responsibilities.[32,38,41,44,57]

In Figure 1, we visually present personal factors and organizational factors as equally important, although we recognize that one or the other category may play a more central role with regard to a specific question of interest. We also show a bidirectional arrow between the personal factors and the organizational factors to emphasize that they may also influence each other.

Applying our model

Our conceptual model of career success for physician-scientists provides a highly flexible template for the generation of more concise and testable analytic models. One could develop derivative models based on his or her particular areas of interest or available data. Such models could range from relatively simple to highly complex.

For example, training program leaders might observe that fewer women are promoted at their institution, as illustrated in Figure 2A. To explore why, they could develop a submodel that introduces one or more potential covariates. The submodel shown in Figure 2B includes two personal factors (female gender and dependent care) plus one career-success factor (promotion) from our comprehensive model. If dependent care for children or elderly parents mediates the gender-promotion association, then (1) gender will be associated with dependent care and dependent care will be associated with promotion, and (2) controlling for dependent care will eliminate the gender-promotion association. The submodel shown in Figure 2C adds an organizational factor (mentoring). With this submodel, training program leaders could determine whether mentoring moderates the effect of dependent care on promotion, and if so, they could focus on increased mentoring as an intervention.

As another example, illustrated in Figure 3, training program leaders might observe that individuals with more research experience are promoted to leadership positions, and so would hypothesize that greater self-efficacy acts as a mediator of this relationship. They might further hypothesize that the association of self-efficacy with leadership will be enhanced by an increase in institutional financial support and a decrease in clinical responsibilities. As with the previous submodel, this submodel uses variables from all three key sets of factors in our comprehensive model yet can be modified to address a specific area of investigation.

As a final example, illustrated in Figure 4, investigators might develop a submodel to determine how personality, psychosocial milieu, and extrinsic success factors are linked with career satisfaction. To determine the direction and strength of the associations, this submodel could be evaluated with multivariable analysis methods (e.g., linear or logistic regression).

Testing our model and potential submodels

We have so far outlined hypothetical examples of the multiple types of submodels that could be derived from our comprehensive career-success model. To test these submodels, however, one needs reliable data for the covariates and outcomes of interest. Leaders of training programs will need to think and plan ahead to determine the kinds of data that they need to collect. They will also need the infrastructure to gather the data and a commitment to

procedures that ensure the consistent enrolling of physician-scientists and collection of data over time.

Our group, for example, wanted to explore several factors associated with burnout among early-stage physician-scientists. For 179 junior investigators, we obtained socioeconomic and other data collected over a two-year period, and we found that differences in the prevalence of burnout were associated with age, gender, and race/ethnicity but not medical specialty.[61] This data represented a good starting point for measuring and observing the appropriate associations but were not sufficient to examine precisely how advanced age, female gender, and minority race/ethnicity contribute to higher rates of burnout among physician-scientists. We continue to gather information by enrolling more junior investigators into our database and also by collecting longitudinal data on all participants. We hope that other program leaders will find this example and our career-success model helpful in testing relationships such as the one that we have described here.

Limitations

We acknowledge that our work is limited in scope. In particular, the primary aim of this phase of our research was to theoretically explore determinants of career success among physician-scientists. We present several illustrations demonstrating how these theoretical associations may apply to important questions related to career success among this group (Figures 2–4). However, it is important to clarify that these do not represent empiric validations of our model, which we leave for future investigations.

Next Steps

The challenges facing physician-scientists today are substantial. Because clinical training is generally arduous, time consuming, and expensive, many physicians leave the investigative pipeline even before they reach the point of embarking on a research career. It, therefore, is important for academic health centers to have in place the supportive environment, infrastructure, policies, mentoring, and other factors that are needed to maximize the chances of success for individuals who begin investigative careers. Current educators, researchers, and other members of the academic community have the responsibility to gather and analyze data that are relevant to efforts aimed at increasing both the number and success rate of physician-scientists. The model that we have proposed includes factors identified in the literature as important for career success and also serves as a conceptual framework for research into what does and does not work in efforts to develop a positive career trajectory for aspiring physician-scientists.

Acknowledgments

The authors are grateful to all of the members of the Research on Careers Workgroup, including Terri Collin Dilmore, Susan Meyer, Diana Ploof, and Joan Lakoski, whose intellectual contributions helped with the development of the conceptual model presented here.

Funding/support: This research was supported by grant KL2 RR024154 and UL1 RR024153 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and the NIH Roadmap for Medical Research.

References

1. Bartels SJ, Lebowitz BD, Reynolds CF 3rd, et al. Programs for developing the pipeline of early-career geriatric mental health researchers: Outcomes and implications for other fields. Acad Med. 2010; 85:26–35. Available at: http://journals.lww.com/academicmedicine/Fulltext/2010/01000/Programs_for_Developing_the_Pipeline_of.14.aspx. [PubMed: 20042817]

2. Teo AR. The development of clinical research training: Past history and current trends in the United States. Acad Med. 2009; 84:433–438. Available at: http://journals.lww.com/academicmedicine/Fulltext/2009/04000/The_Development_of_Clinical_Research_Training_.12.aspx. [PubMed: 19318772]
3. Yager J, Waitzkin H, Parker T, Duran B. Educating, training, and mentoring minority faculty and other trainees in mental health services research. Acad Psychiatry. 2007; 31:146–151. [PubMed: 17344457]
4. Young RA, Dehaven MJ, Passmore C, Baumer JG. Research participation, protected time, and research output by family physicians in family medicine residencies. Fam Med. 2006; 38:341–348. [PubMed: 16673196]
5. Nathan DG. Clinical research: Perceptions, reality, and proposed solutions. National Institutes of Health Director's Panel on Clinical Research. JAMA. 1998; 280:1427–1431. [PubMed: 9801003]
6. Daley S, Wingard DL, Reznik V. Improving the retention of underrepresented minority faculty in academic medicine. J Natl Med Assoc. 2006; 98:1435–1440. [PubMed: 17019910]
7. Gusic ME, Milner RJ, Tisdell EJ, Taylor EW, Quillen DA, Thorndyke LE. The essential value of projects in faculty development. Acad Med. 2010; 85:1484–1491. Available at: http://journals.lww.com/academicmedicine/Abstract/2010/09000/The_Essential_Value_of_Projects_in_Faculty22.aspx. [PubMed: 20671538]
8. Rust G, Taylor V, Herbert-Carter J, Smith QT, Earles K, Kondwani K. The Morehouse Faculty Development Program: Evolving methods and 10-year outcomes. Fam Med. 2006; 38:43–49. [PubMed: 16378258]
9. Hamel MB, Ingelfinger JR, Phimister E, Solomon CG. Women in academic medicine--Progress and challenges. N Engl J Med. 2006; 355:310–312. [PubMed: 16855274]
10. Hitchen L. Women are still left behind in academic medicine. BMJ. 2007; 335:119. [PubMed: 17641329]
11. Levinson W, Kaufman K, Clark B, Tolle SW. Mentors and role models for women in academic medicine. Western Journal of Medicine. 1991; 154:423–426. [PubMed: 1877183]
12. Allen T, Day R, Lentz E. The role of interpersonal comfort in mentoring relationships. Journal of Career Development. 2005; 31:155–169.
13. Carr PL, Ash AS, Friedman RH, et al. Relation of family responsibilities and gender to the productivity and career satisfaction of medical faculty. Ann Intern Med. 1998; 129:532–538. [PubMed: 9758572]
14. Bellini LM, Abbuhl S, Grisso JA, Lavizzo-Mourey R, Shea JA. Stresses and workplace resources for academic junior faculty: Track and gender comparisons. Acad Med. 2001; 76:S62–S64. Available at: http://journals.lww.com/academicmedicine/Fulltext/2001/10001/Stresses_and_Workplace_Resources_for_Academic.21.aspx. [PubMed: 11597875]
15. Colletti LM, Mulholland MW, Sonnad SS. Perceived obstacles to career success for women in academic surgery. Archives of Surgery. 2000; 135:972–977. [PubMed: 10922261]
16. McPhillips HA, Burke AE, Sheppard K, Pallant A, Stapleton FB, Stanton B. Toward creating family-friendly work environments in pediatrics: Baseline data from pediatric department chairs and pediatric program directors. Pediatrics. 2007; 119:e596–e602. [PubMed: 17283180]
17. Lewis-Stevenson S, Hueston WJ, Mainous AG 3rd, Bazell PC, Ye X. Female and underrepresented minority faculty in academic departments of family medicine: Are women and minorities better off in family medicine? Fam Med. 2001; 33:459–465. [PubMed: 11411975]
18. Agrawal JR, Vlaicu S, Carrasquillo O. Progress and pitfalls in underrepresented minority recruitment: perspectives from the medical schools. J Natl Med Assoc. 2005; 97:1226–1231. [PubMed: 16296213]
19. Nivet MA, Taylor VS, Butts GC, et al. Diversity in academic medicine no. 1 case for minority faculty development today. Mt Sinai J Med. 2008; 75:491–498. [PubMed: 19021210]
20. Peterson NB, Friedman RH, Ash AS, Franco S, Carr PL. Faculty self-reported experience with racial and ethnic discrimination in academic medicine. J Gen Intern Med. 2004; 19:259–265. [PubMed: 15009781]

21. Price EG, Gozu A, Kern DE, et al. The role of cultural diversity climate in recruitment, promotion, and retention of faculty in academic medicine. J Gen Intern Med. 2005; 20:565–571. [PubMed: 16050848]
22. Palepu A, Carr PL, Friedman RH, Ash AS, Moskowitz MA. Specialty choices, compensation, and career satisfaction of underrepresented minority faculty in academic medicine. Acad Med. 2000; 75:157–160. Available at: http://journals.lww.com/academicmedicine/Fulltext/2000/02000/Specialty_Choices,_Compensation,_and_Career.14.aspx. [PubMed: 10693848]
23. Buddeberg-Fischer B, Stamm M, Buddeberg C. Academic career in medicine: Requirements and conditions for successful advancement in Switzerland. BMC Health Serv Res. 2009; 9:70. [PubMed: 19402885]
24. Feldman MD, Arean PA, Marshall SJ, Lovett M, O'Sullivan P. Does mentoring matter: Results from a survey of faculty mentees at a large health sciences university. Med Educ Online. 2010; 15
25. Jackson VA, Palepu A, Szalacha L, Caswell C, Carr PL, Inui T. "Having the right chemistry": A qualitative study of mentoring in academic medicine. Acad Med. 2003; 78:328–334. Available at: http://journals.lww.com/academicmedicine/Fulltext/2003/03000/_Having_the_Right_Chemistry___A_Qualitative_Study.20.aspx. [PubMed: 12634219]
26. Straus SE, Chatur F, Taylor M. Issues in the mentor-mentee relationship in academic medicine: A qualitative study. Acad Med. 2009; 84:135–139. Available at: http://journals.lww.com/academicmedicine/Fulltext/2009/01000/Issues_in_the_Mentor_Mentee_Relationship_in.36.aspx. [PubMed: 19116493]
27. Shollen SL, Bland CJ, Finstad DA, Taylor AL. Organizational climate and family life: How these factors affect the status of women faculty at one medical school. Acad Med. 2009; 84:87–94. Available at: http://journals.lww.com/academicmedicine/Fulltext/2009/01000/Organizational_Climate_and_Family_Life__How_These.26.aspx. [PubMed: 19116483]
28. Steiner JF, Curtis P, Lanphear BP, Vu KO, Main DS. Assessing the role of influential mentors in the research development of primary care fellows. Acad Med. 2004; 79:865–872. Available at: http://journals.lww.com/academicmedicine/Fulltext/2004/09000/Assessing_the_Role_of_Influential_Mentors_in_the.12.aspx. [PubMed: 15326013]
29. Sambunjak D, Straus SE, Marusic A. Mentoring in academic medicine: A systematic review. JAMA. 2006; 296:1103–1113. [PubMed: 16954490]
30. Chung K, Song J, Kim H, et al. Predictors of job satisfaction among academic faculty members: Do instructional and clinical staff differ? Medical Education. 2010; 44:985–995. [PubMed: 20880368]
31. Underhill CM. The effectiveness of mentoring programs in corporate settings: A meta-analytical review of the literature. Journal of Vocational Behavior. 2006; 68:292–307.
32. Buckley LM, Sanders K, Shih M, Kallar S, Hampton C. Obstacles to promotion? Values of women faculty about career success and recognition. Acad Med. 2000; 75:283–288. Available at: http://journals.lww.com/academicmedicine/Fulltext/2000/03000/Obstacles_to_Promotion__Values_of_Women_Faculty.21.aspx. [PubMed: 10724319]
33. Dries N, Pepermans R, Carlier O. Career success: Constructing a multidimensional model. Journal of Vocational Behavior. 2008; 73:254–267.
34. Dyke LS, Murphy SA. How we define success: A qualitative study of what matters most to women and men. Sex Roles: A Journal of Research. 2006; 55:357–372.
35. Hennequin E. What "career success" means to blue-collar workers. Career development international. 2007; 12:565–581.
36. Judge TA, Piccolo RF, Podsakoff NP, Shaw JC, Rich BL. The relationship between pay and job satisfaction: A meta-analysis of the literature. Journal of Vocational Behavior. 2010; 77:157–167.
37. Nabi GR. The relationship between HRM, social support and subjective career success among men and women. International Journal of Manpower. 2001; 22:457–474.
38. Pachulicz S, Schmitt N, Kuljanin G. A model of career success: A longitudinal study of emergency physicians. Journal of Vocational Behavior. 2008; 73:242–253.
39. Judge T, Cable D, Boudreau J, Bretz R. An empirical investigation of the predictors of executive career success. Personnel Psychology. 1995; 48:485–519.

40. Sturges J. What it Means to Succeed: Personal Conceptions of Career Success Held by Male and Female Managers at Different Ages. British Journal of Management. 1999; 10(3 SPEC. ISS.):239–252.
41. Buckley LM, Sanders K, Shih M, Hampton CL. Attitudes of clinical faculty about career progress, career success and recognition, and commitment to academic medicine. Results of a survey. Arch Intern Med. 2000; 160:2625–2629. [PubMed: 10999976]
42. Clark DC, Morrison DE, Fawcett J. Is capacity for pleasure associated with executive career success? J Occup Med. 1984; 26:37–40. [PubMed: 6694007]
43. Kalet AL, Fletcher KE, Ferdman DJ, Bickell NA. Defining, navigating, and negotiating success: The experiences of mid-career Robert Wood Johnson Clinical Scholar women. J Gen Intern Med. 2006; 21:920–925. [PubMed: 16918735]
44. McBride AB. Toward a roadmap for interdisciplinary academic career success. Res Theory Nurs Pract. 2010; 24:74–86. [PubMed: 20333914]
45. Lau V, Shaffer M. Career success: the effects of personality. Career development international. 1999; 4:225–230.
46. Parker B, Chusmir LH. Motivation needs and their relationship to life success. Human Relations. 1991; 44:1301–1312.
47. Kern ML, Friedman HS, Martin LR, Reynolds CA, Luong G. Conscientiousness, career success, and longevity: A lifespan analysis. Ann Behav Med. 2009; 37:154–163. [PubMed: 19455378]
48. Kogan LR, McConnell SL, Schoenfeld-Tacher R. Gender differences and the definition of success: Male and female veterinary students' career and work performance expectations. J Vet Med Educ. 2004; 31:154–160. [PubMed: 15181598]
49. O'Brecht M, Friesen H. Predicting career success. Science. 1996; 273:1156–1157. [PubMed: 8787117]
50. Judge TA, Klinger RL, Simon LS. Time is on my side: Time, general mental ability, human capital, and extrinsic career success. J Appl Psychol. 2010; 95:92–107. [PubMed: 20085408]
51. Hilgenkamp KD, Livingston MM. Tomboys, masculine characteristics, and self-ratings of confidence in career success. Psychol Rep. 2002; 90:743–749. [PubMed: 12090501]
52. Holland MG, Black CH, Miner JB. Using managerial role motivation theory to predict career success. Health Care Manage Rev. 1987; 12:57–64. [PubMed: 3692849]
53. Melnyk BM. Big dreams, belief and persistence: Essential elements for achieving career success. Adv Nurse Pract. 2001; 9:85–86. [PubMed: 12400331]
54. Seibert SE, Crant JM, Kraimer ML. Proactive personality and career success. J Appl Psychol. 1999; 84:416–427. [PubMed: 10380421]
55. Sutin AR, Costa PT, Miech R, Eaton WW. Personality and Career Success: Concurrent and Longitudinal Relations. Eur J Pers. 2009; 23:71–84. [PubMed: 19774106]
56. Amabile TM, Hill KG, Hennessey BA, Tighe EM. The work preference inventory: Assessing intrinsic and extrinsic motivational orientations. J Pers Soc Psychol. 1994; 66:950–967. [PubMed: 8014837]
57. Myerson N. Do school exams predict doctors' success? Career achievements are not only measure. BMJ. 2003; 327:810. [PubMed: 14525895]
58. Peluchette JV, Jeanquart S. Professionals' use of different mentor sources at various career stages: Implications for career success. J Soc Psychol. 2000; 140:549–564. [PubMed: 11059201]
59. Rojas-Guyler L, Murnan J, Cottrell RR. Networking for career-long success: A powerful strategy for health education professionals. Health Promot Pract. 2007; 8:229–233. [PubMed: 17606950]
60. Wolff HG, Moser K. Effects of networking on career success: A longitudinal study. J Appl Psychol. 2009; 94:196–206. [PubMed: 19186904]
61. Primack BA, Dilmore TC, Switzer GE, et al. Burnout among early career clinical investigators. Clin Transl Sci. 2010; 3:186–188. [PubMed: 20718821]

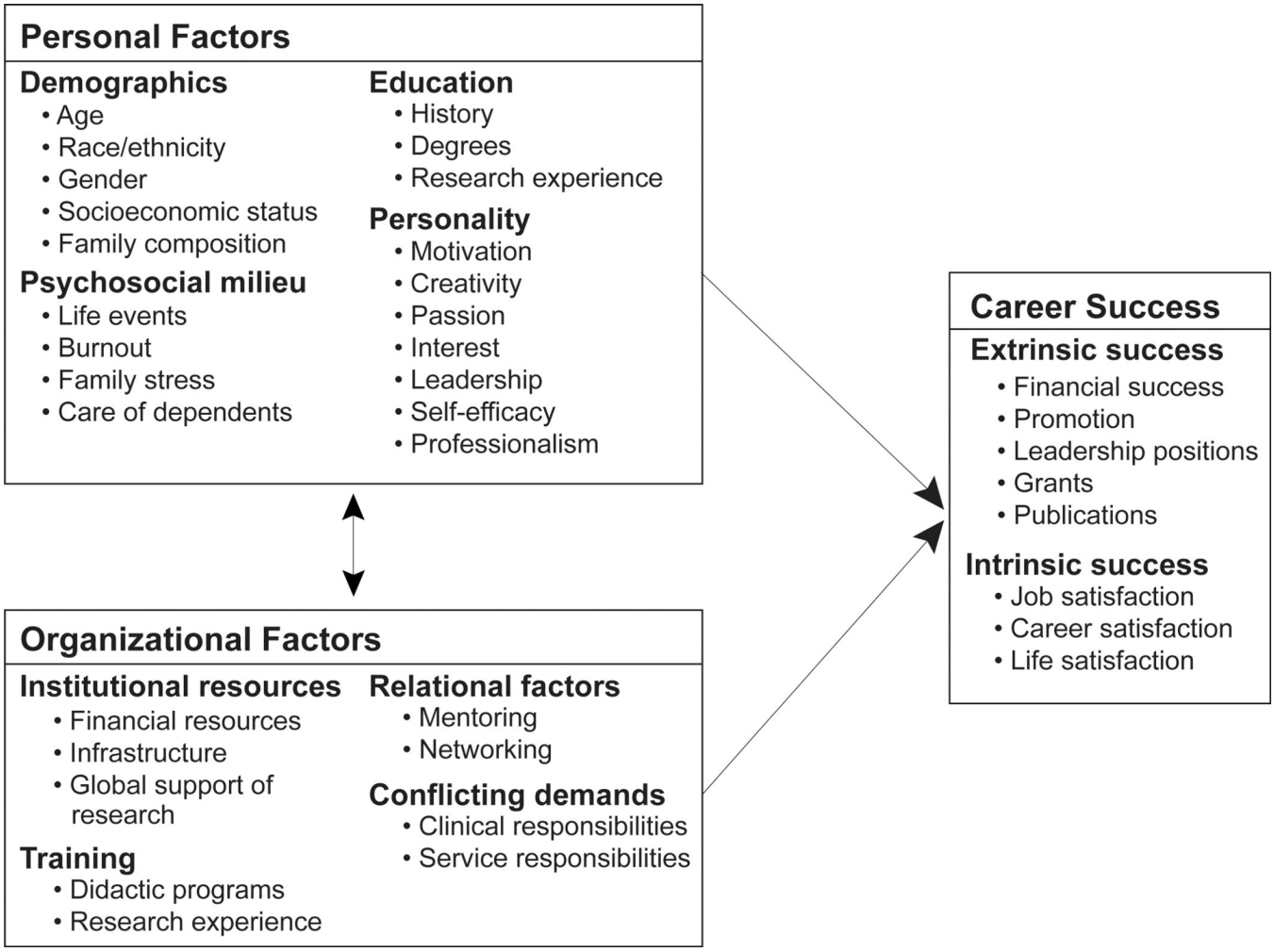

Figure 1.
Visual representation of a comprehensive career-success model for physician-scientists developed by the University of Pittsburgh Institute for Clinical Research Education Research on Careers Workgroup, 2010.

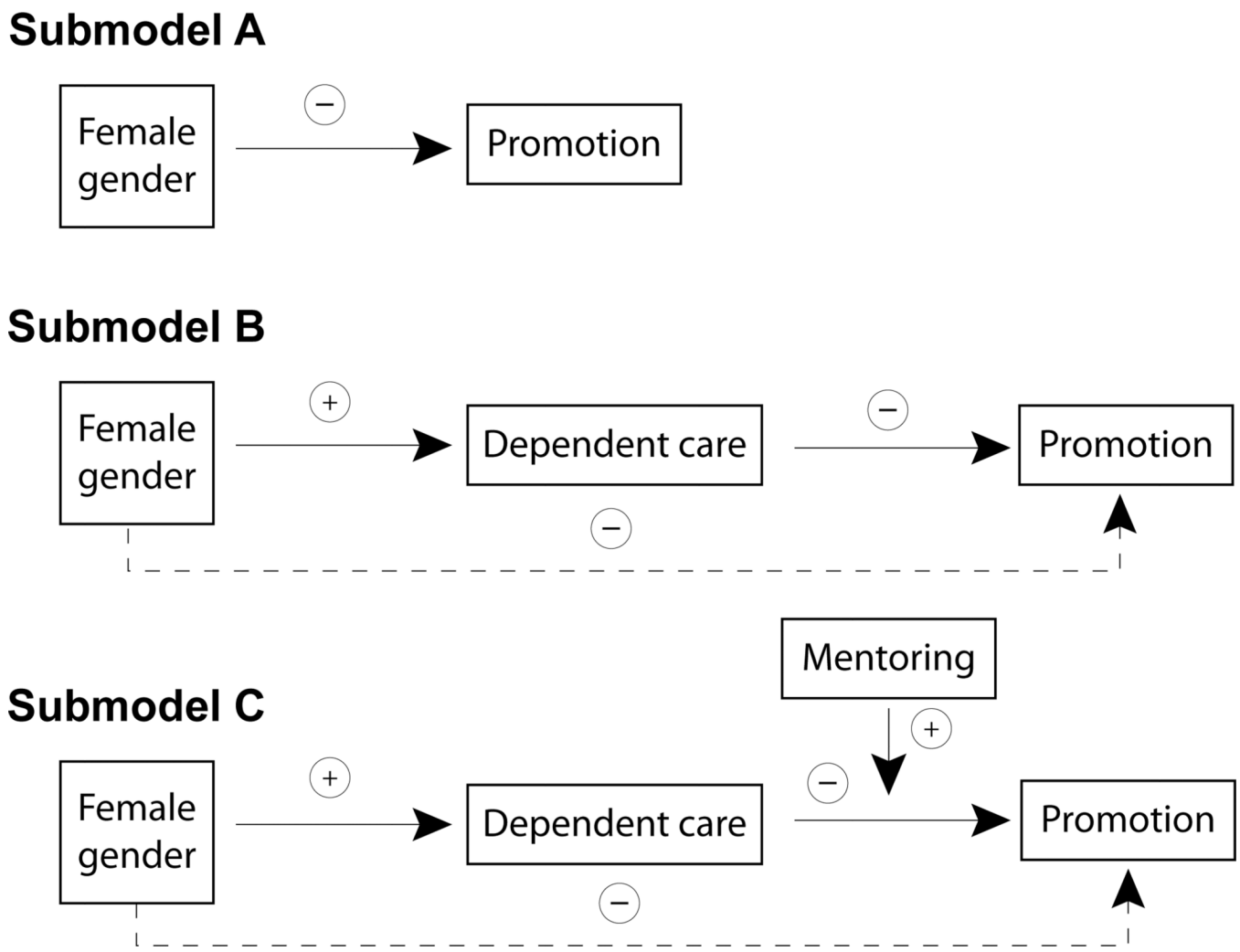

Figure 2.
Three submodels hypothesizing the associations between gender and promotion in career development, based on a comprehensive career-success model for physician-scientists developed by the University of Pittsburgh Institute for Clinical Research Education Research on Careers Workgroup, 2010. Submodel A shows a negative link between one personal factor (female gender) and one career-success factor (promotion). Submodel B includes two personal factors (female gender and dependent care) plus one career-success factor (promotion). Submodel C adds an organizational factor (mentoring). According to our model, if the need to provide dependent care acts as a mediator and decreases the chances of promotion for a physician-scientist, then the introduction of mentoring may counter this effect and increase the chances of promotion.

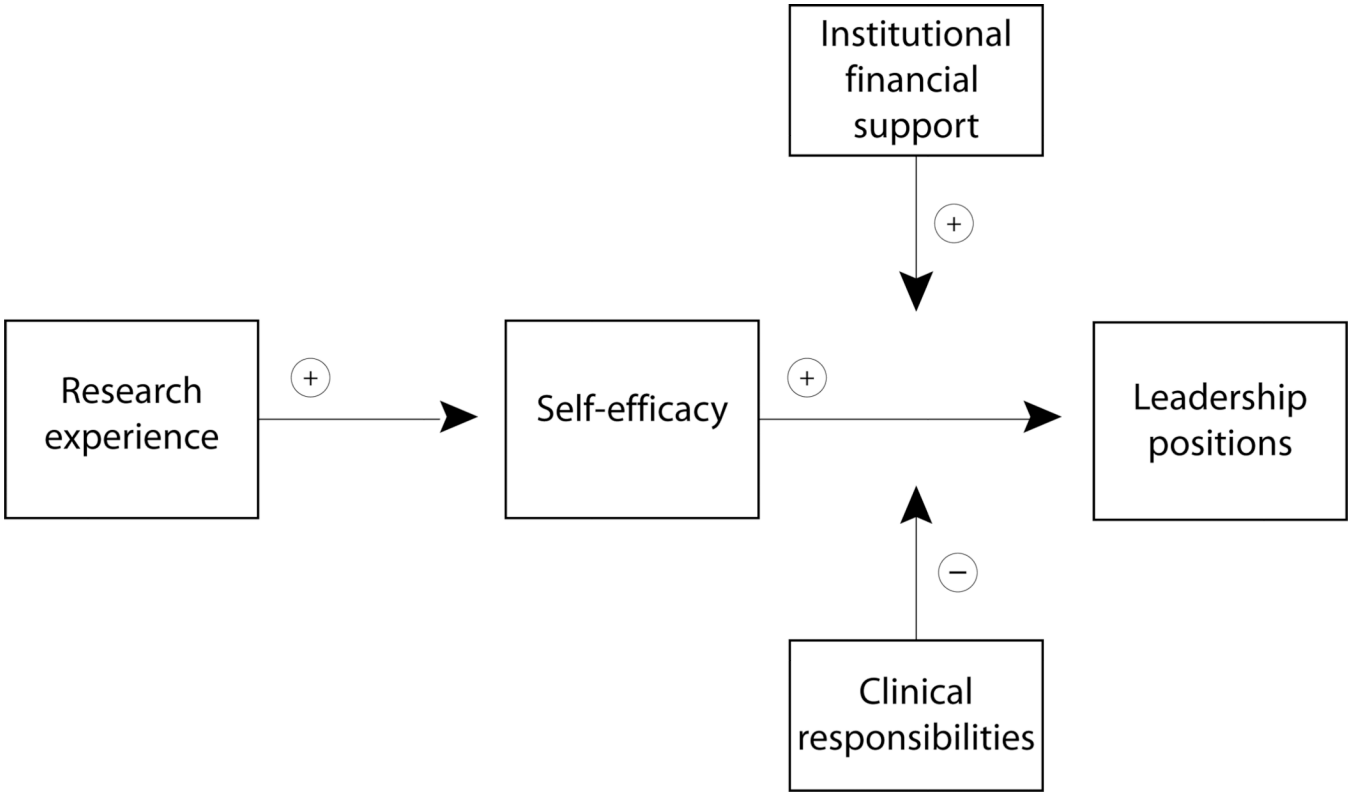

Figure 3.
Submodel hypothesizing the relationship between research experience and leadership positions, based on a comprehensive career-success model for physician-scientists developed by the University of Pittsburgh Institute for Clinical Research Education Research on Careers Workgroup, 2010According to the model, if greater self-efficacy acts as a mediator, then the association of self-efficacy with leadership may be enhanced by an increase in institutional financial support and a decrease in clinical and/or educational responsibilities.

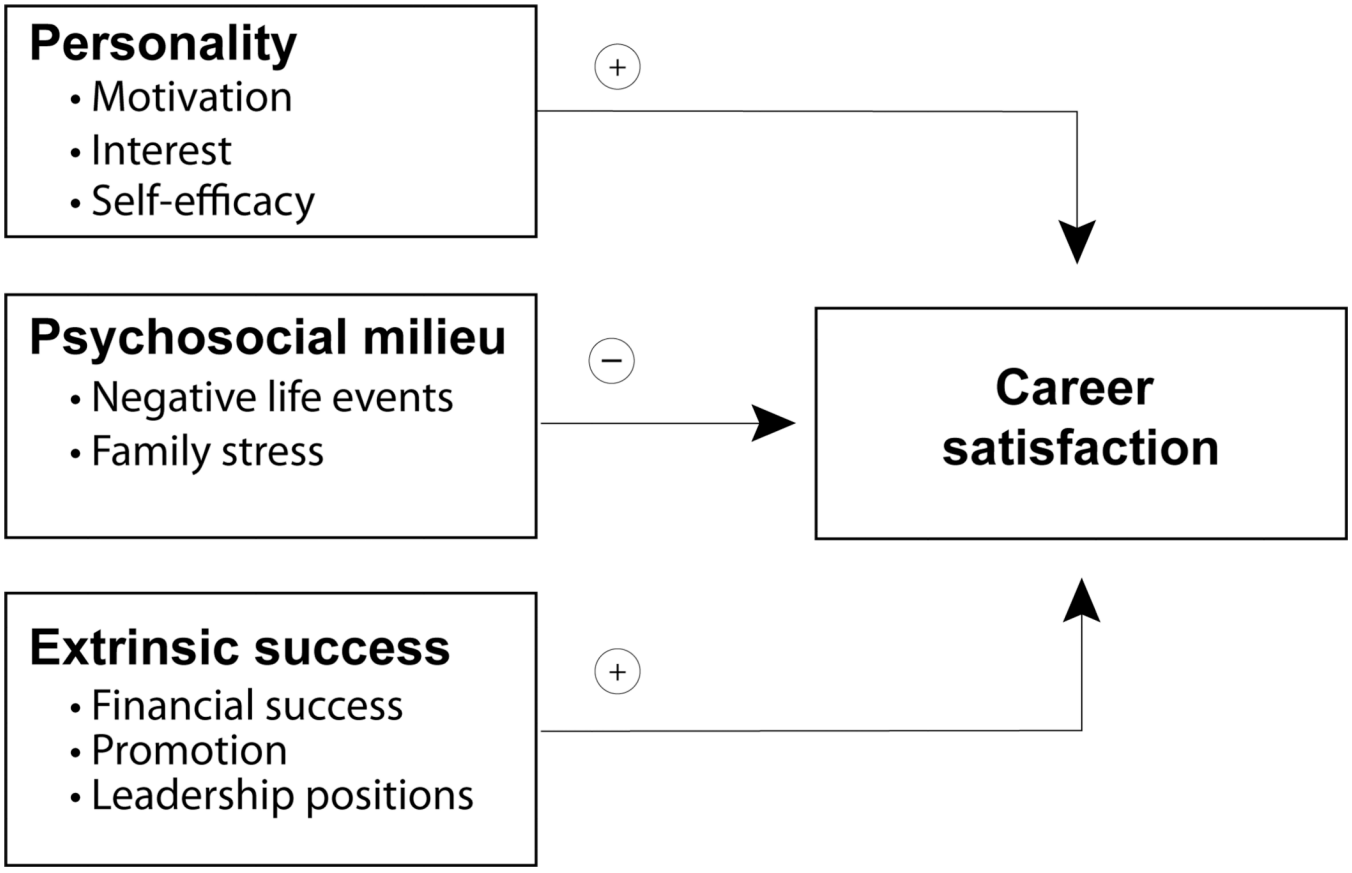

Figure 4.
Submodel hypothesizing how personality, psychosocial milieu, and extrinsic success factors are linked with career satisfaction, based on a comprehensive career-success model for physician-scientists developed by the University of Pittsburgh Institute for Clinical Research Education Research on Careers Workgroup, 2010. According to the model, to determine the direction and strength of the associations, this submodel could be evaluated with multivariable analysis methods (e.g., linear or logistic regression).