A Model for Developing, Evaluating, and Disseminating Best Practices in Education and Training

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Abstract

With the shift toward team-based translational science came recognition that existing strategies for training individual investigators and retaining them in the biomedical workforce would be inadequate. To support this shift, it is important to: develop innovative strategies to educate and train diverse members of research teams; evaluate those programs; and disseminate best practices broadly. We have developed a four-phase model to facilitate the development, evaluation, and widespread dissemination of innovative strategies to train the biomedical research workforce. Phase I (Innovate) involves small scale trials of programs to address perceived training needs or new methods of delivery. Phase II (Incubate) refines and evaluates promising Phase I activities on a larger scale. Phase III (Translate) seeks to replicate initial successes either locally (Phase IIIa) or with other interested institutions (Phase IIIb). Phase IV (Disseminate) assesses whether identified local best practices can have success on a broader scale. We present specific examples from our own experience that demonstrate the utility of this model, and then conclude with opportunities and challenges related to the education and training of this workforce. Clin Trans Sci 2014; Volume 7: 402–405

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Introduction

For more than a decade, the biomedical research enterprise has been characterized by a distinct shift toward team-based clinical and translational science.[1,2] With this shift came the recognition that existing strategies to train members of the research workforce would be inadequate to prepare the research teams of the future. Instead, education, training, and career development (ETCD) activities must help develop a workforce that is diverse in terms of their roles (e.g., principal investigators, co-investigators, implementers/collaborators, community practitioners, and stakeholders such as patients and advocates), individual characteristics, and scientific areas (e.g., basic science, informatics, biostatistics, and/or clinical experts).[3,4] Because research training requires a substantial investment of time and resources, an equally pressing need is to retain these trainees in the biomedical workforce.[5] For these reasons, ETCD activities were required in the NIH Clinical and Translational Science Award (CTSA) Program.

A recent Institute of Medicine (IOM) report recognized the substantial contributions that CTSAs have made in advancing clinical and translational research.[6] This report also highlighted the importance of preparing the future research workforce. In this regard, the IOM report offered recommendations related to ETCD activities within CTSAs. First, ETCD programs must: (1) develop innovative models that emphasize team science, leadership, community engagement, and entrepreneurship; (2) disseminate successful activities online for use by the CTSA consortium and non-CTSA institutions; (3) champion career development paths for investigators conducting clinical and translational research; and (4) tailor training to diverse audiences, which may include graduate degrees in clinical and translational science.[7] Secondly, and more broadly, the IOM committee "envisions a transformation of the CTSA Program from its current, loosely organized structure into a more tightly integrated network that works collectively to . . . disseminate innovative translational research methods and best practices. . ."[7] Taken together, these recommendations require that CTSAs develop innovative: (1) programs to educate and train members of research teams of the future; (2) strategies tailored to individuals' specific roles on these teams; and (3) processes to evaluate programs and disseminate best practices beyond any single CTSA.

Given the importance of ETCD activities for clinical and translational research that improves population health, it is essential to develop and disseminate best practices across the CTSA consortium. To this end, the North Carolina Translational and Clinical Sciences (NC TraCS) Institute, the integrated home of the University of North Carolina-Chapel Hill (UNC-CH) CTSA, has developed a four-phase NC TraCS Education Development and Evaluation Model (*Figure 1*). The structure of our model is based loosely on the four phases of clinical testing for new pharmaceutical products. In the subsequent sections, we provide a brief overview of this model, as well as examples from our own CTSA to illustrate its use in practice.

The NC TraCS Education Development and Evaluation Model: overview

In Phase I (*Innovate*), we conduct preliminary small-scale trials of programs intended to address specific training needs. Given the diversity of team members' roles, we prioritize programs that can be tailored to individual trainees using a hybrid learning model that includes: (1) didactic courses; (2) individual and team-based cases to enhance participants' ability to solve "real-world" problems; (3) panel discussions in which investigators share their experiences regarding facilitators, barriers and strategies for success; and (4) small groups in which participants provide and receive constructive feedback that demonstrates core competencies. Typically, evaluation in this phase is based on debriefing sessions with participants (program faculty and learners), as well as preliminary metrics of success (when applicable). To move onto

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Figure 1. NC TraCS Education Development and Evaluation Model.

Program	Overall objectives	Short/long term goals	Data collected
Mock review program	Provide NIH-style reviews and feedback on proposals Demonstrate how study sections operate Teach trainees how to review a grant Model a team-based approach to proposal preparation Encourage retention of investigators	Identify potential issues in grant proposals before submission Advise participants about strategies to increase their funding success rate	Number of proposals submitted/funded Number of proposals undergoing review by outside reviewers Scholar perceptions of program
K-seminar	Provide regular opportunities for K Scholars to share research across disciplines Teach junior investigators how to provide and receive constructive feedback	Help Scholars overcome difficulties encountered in their own work Encourage creation of interdisciplinary relationships and research teams among Scholars	Creation of interdisciplinary teams among K Scholars Number of interdisciplinary awards (pilot or otherwise) funded Scholar perceptions of program
R-writing group	Teach junior investigators how to write their first R-type awards Teach junior investigators how to mentor and provide constructive feedback to others Encourage retention of investigators	Investigator prepares and submits first R-type proposal Train the next generation of research mentors	Number of proposals submitted/funded Participant's future activities in teaching proposal writing

Table 1. Selected programs, objectives, goals, and data collected.

Phase II, ETCD leadership must view the program as having the potential for broader-scale dissemination at UNC-CH.

Phase II (*Incubate*) occurs for those Phase I activities for which preliminary data suggests promising results. During Phase II, we often revise the content and/or structure of the Phase I program based upon participants' evaluations. Phase II involves more formal evaluation strategies, including structured interviews with participants. In addition, we typically specify key outcomes in advance. Notably, Phase II is often iterative, and several refinements to the program may be necessary before moving onto Phase III.

Phase III (*Translate*) involves evaluating whether initial Phase II success can be replicated throughout UNC-CH (Phase IIIa) and/or within interested members of the CTSA consortium (Phase IIIb). Notably, not all programs should or will continue to Phase IIIb because the content may be specific to local environments (e.g., aspects of achieving promotion and tenure). As with Phase II, we use debriefing sessions with participants and specify key outcomes in advance to evaluate these activities. Based on the evaluation during Phase III, we will also identify refinements that may be needed before recommending programs for broader dissemination in Phase IV.

Phase IV (*Disseminate*) focuses on assessing whether we can achieve widespread benefit across the CTSA Consortium. For example, one site may provide infrastructure to support a cross-CTSA activity or simply disseminate best practices across CTSAs. It should be noted that for some activities, barriers to cross-CTSA participation may be revealed (e.g., protection of confidentiality, data security). Because no program has yet reached Phase IV, we have not developed an implementation strategy. We expect to standardize the evaluations across sites using both feedback from participants and measurable outcomes.

The NC TraCS Education Development and Evaluation Model: examples

To demonstrate how we use the NC TraCS Education Development and Evaluation Model in practice, we describe three activities: mock review program, K-seminar, and R-writing groups (*Table 1*).

Mock review program

Mock reviews have been integral to our curriculum for more than a decade. We identify a team of expert reviewers and ETCD faculty to formally review a junior investigator's grant proposal using the NIH study section format; ideally the reviews occur approximately 2 months prior to submission. Our early metrics for success included our abilities to: organize and hold mock reviews within a suitable time frame; engage expert reviewers; and provide investigators with useful feedback that improved the quality of their grant proposals. Junior investigators whose proposals underwent mock reviews consistently reported that the process not only improved the quality of the proposal, but also extended the applicant's scientific network. In some cases, reviewers served as mentors, collaborators and/or consultants on subsequent grants. Besides strengthening individual applications, mock reviewers teach observers about the criteria senior investigators use to evaluate proposals. Initially (*Figure 2*), mock reviews were arranged for junior faculty supported by our KL2 and K12 programs only (Phase I); however, the extremely positive feedback from participants convinced us to expand mock reviews to wider audiences at UNC-CH, including MD/PhD students writing NIH F-type proposals (Phase II). We also helped senior mentors in departments without formal training programs to organize mock reviews for their own mentees (Phase IIIa). As a result, the demand for organizing mock reviews grew; however,

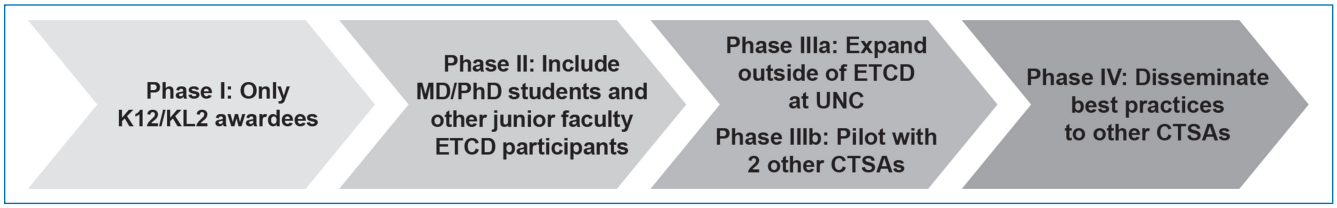

Figure 2. NC TraCS Education Development and Evaluation Model applied to mock review program.

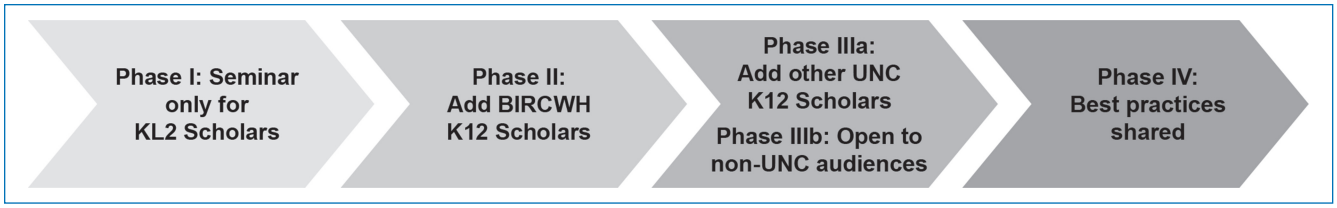

Figure 3. NC TraCS Education Development and Evaluation model applied to K seminar.

the increased scientific diversity of proposals sometimes made it difficult to identify appropriate UNC-CH faculty reviewers. This led us to initiate collaborations with local universities (Duke University and North Carolina State University). During the past year, we successfully completed mock reviews jointly with CTSAs at the University of Wisconsin and the University of Southern California (Phase IIIb). Notably, reviewers at UNC and other CTSA institutions have participated without financial remuneration. Remarkably, we have had little difficulty convincing reviewers, both at UNC and at other institutions, to participate in the program. We believe this is because they (or their mentees) have either directly benefitted from mock reviews, they anticipate using the mock review program for their own proposals in the future, or they simply recognize the intrinsic value of the program. As we develop formal protocols for best practices for mock reviews, we will disseminate these practices throughout the CTSA Consortium. We recognize that, should faculty require payment to participate in activities, this may be a barrier to widespread implementation (especially for investigators outside their own institution).

K-seminar

In this required component of our KL2 program, Scholars use bi-weekly, one-hour K seminars to: present a "Works-in-Progress" session; review ideas for grant proposals: rehearse national talks; receive feedback on draft publications; review summary statements/discuss strategies for grant resubmission; and receive advice on their current research activities and overall career path. Specifically, these sessions allow Scholars to draw on the experiences of both peers and senior faculty as they develop their research proposals, thus enhancing the likelihood of receiving independent funding. As can be seen in *Figure 3*, we next invited Scholars from the Building Interdisciplinary Research Careers in Women's Health (BIRCWH) K12 Program to attend K seminar alongside KL2 Scholars (Phase II). And, during the past 5 years, we have integrated Scholars supported by three other institutional K12 Programs: Comparative Effective Research; Oncology; and Benign Hematology (Phase IIIa). Doing so has had several advantages, including: (1) fostering Scholars' abilities to communicate across scientific disciplines, a skill essential for team science; (2) creating a forum for KL2/K12 Scholars to learn more about, and become engaged in, other types of research; (3) promoting collaboration among these Scholars; and (4) providing methodological and analytical input and advice from ETCD Biostatistics/Epidemiology Service faculty who attend these seminars. We applied the NC TraCS Education Development and Evaluation Model to pilot and evaluate new aspects of the K seminar. For example, although expanding our audience increased the diversity of attendees, the increased size posed challenges. We are in the process of introducing concurrent seminars in which Scholars meet in smaller groups, the composition of which will change during the year. This should allow Scholars to present more often (and therefore foster rapid progress), while still receiving input from colleagues in different disciplines. If successful, we will identify another CTSA to evaluate the seminar across programs (Phase IIIb) and, ultimately, expand best practices for K-seminars across the CTSA consortium (Phase IV).

R-writing groups

Even with strong research training, it is often difficult for junior investigators to transition to their first independent investigator-initiated research grant. To address this issue, we applied the NC TraCS Education Development and Evaluation Model to what is now our R-writing groups (*Figure 4*). In 2008, we initiated a "K2R Writing Group" in which two senior faculty mentored six junior investigators (all former or current K-awardees) writing their first R-type grant (Phase I). The initial goals, specified in advance, were to provide a structure within which we could facilitate participants' learning to both write their first R-type grant and provide feedback to their peers. Qualitative feedback received during the formal evaluation revealed that while all participants learned much from working together, they thought that combining T1 and T2 researchers in the same group was suboptimal. Specifically, because R-type grant proposals for T1 and T2 research differed substantially (e.g., role of preliminary data, specific aims, methodologies), participants reported being unable to contribute fully in developing and reviewing each other's grants. In addition, participants stated that junior faculty would benefit substantially from co-leading the group with a senior investigator. Thus, in 2009, the T1 group added a former

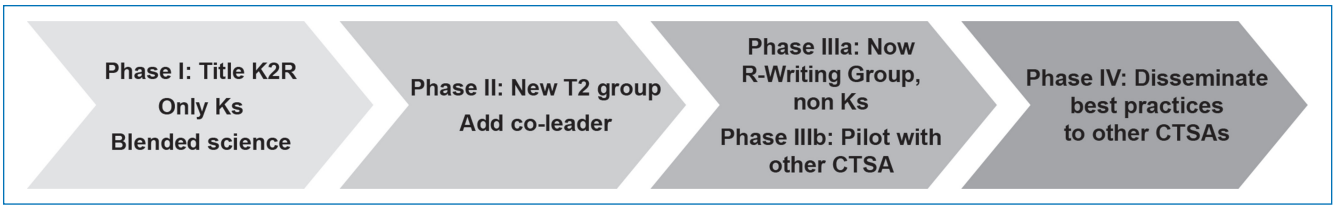

Figure 4. NC TraCS Education Development and Evaluation Model applied to R-writing groups.

participant (a past KL2 Scholar) who has his own independent funding as co-leader; and in 2010, we began a T2 group (Phase II) that also was co-led by a past KL2 Scholar. Having successful KL2 Scholars participate as co-leaders provides them with leadership and mentoring experience that is vital to their long-term careers. Unlike mock reviews that involved a circumscribed activity, co-leaders of R-writing groups provide a sustained commitment for approximately 9 months. Thus, we provide ~10% salary support for each co-leader of the T1 and T2 groups. Notably, these more junior co-leaders will have the opportunity to develop their mentoring skills, which may be especially helpful for those planning to submit a mid-career mentoring award. We then expanded the opportunity to participate in the R-writing group to all junior investigators at UNC-CH, rather than restrict it to recipients of K-awards (Phase IIIa). The next step will be to identify another CTSA interested in working across institutions (Phase IIIb). A cross-CTSA program has many potential advantages (e.g., establishing long-term collaborations, providing faculty with specialized expertise); however, there are logistical and technical challenges to being in two locations. Perhaps more challenging is addressing participants' and mentors' concerns about sharing innovative ideas outside the applicant's team and institution. Having participants sign confidentiality agreements is one option to consider. Ultimately, if we can demonstrate interest and feasibility with another CTSA, we will seek to disseminate best practices across CTSAs that address the logistical, technical and scientific issues (Phase IV).

Discussion

The NIH Roadmap Initiative was launched to increase the speed with which basic science discoveries can be translated into real world practices that improve population health. The NIH recognized that achieving this goal meant that future interdisciplinary research teams would require different training and ongoing career development. In developing innovative educational strategies to train and develop the careers of the future work force, we should not assume that what "makes sense" will work; neither should we assume that it will be simple to develop effective training strategies. Rather, we should have a deliberate, evidence-based plan to identify pragmatic best practices that can be disseminated across the CTSA Consortium. One example of such an approach is a randomized controlled trial conducted in 16 CTSA sites demonstrating the effectiveness of a competency-based research mentor training program.[7]

The NC TraCS Education Development and Evaluation Model provides a blueprint for how one can systematically develop effective ETCD activities. It uses a 4-phase model (innovate, incubate, translate, disseminate) that parallels how areas such as drug and technology development systematically move from early stage findings through postmarketing surveillance. As with drug development, our model outlines a strategy that allows for modification, or even abandonment, as a response to new information. Thus, most activities will require refinement along the way, and not all activities will proceed to the next phase. Decisions will be based upon formal evaluations. We have described three specific examples of how we applied this model to our ETCD programs. Notably, we have several other ETCD initiatives at various phases, including activities related to leadership, mentoring skills, and the responsible conduct of research.

Our approach seeks to address several challenges put forth by the IOM, especially the importance of innovative educational strategies and collaborating across the CTSA consortium. As we look forward, one challenge that we have not discussed is how to more effectively use rapidly evolving technology in education (e.g., online courses). However, that should be seen as yet another tool in our armamentarium and one that may provide an opportunity to leverage strengths of other CTSAs. Moreover, the ultimate success of our activities should be judged by our ability to disseminate evidence-based programs throughout the CTSA consortium. To date, we have not attempted Phase IV activities, but expect to do so soon.

This is an exciting time in clinical and translational science as we seek to rapidly disseminate research findings into practices that improve population health. This enterprise depends on training team members and then retaining them as members of research teams. This is precisely why education training is critical to the overall success of the CTSA.

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