Published in final edited form as:

Acad Med. 2010 March ; 85(3): 463–469. doi:10.1097/ACM.0b013e3181ccc877.

Reengineering the National Clinical and Translational Research Enterprise: The Strategic Plan of the National Clinical and Translational Science Awards Consortium

Steven E. Reis, MD,

Director of the University of Pittsburgh Clinical and Translational Science Institute, Pittsburgh, PA

Lars Berglund, MD, PhD,

Director of the University of California, Davis Clinical and Translational Science Center, Sacramento, CA

Gordon R. Bernard, MD,

Director of the Vanderbilt Institute for Clinical and Translational Research, Nashville, TN

Robert M. Califf, MD,

Director of the Duke Translational Medicine Institute, Durham, NC

Garret A. FitzGerald, MD, and

Director of the University of Pennsylvania Institute for Translational Medicine and Therapeutics

Peter C. Johnson, MD [on behalf of for the National Clinical and Translational Science Awards Consortium]

President and Chief Executive Officer of Scintellix, LLC, Raleigh, NC

Abstract

Advances in human health require the efficient and rapid translation of scientific discoveries into effective clinical treatments; this process in turn depends upon observational data gathered from patients, communities, and public-health research that can be used to guide basic scientific investigation. Such bidirectional translational science, however, faces unprecedented challenges due to the rapid pace of scientific and technological development, as well as the difficulties of negotiating increasingly complex regulatory and commercial environments that overlap the research domain. Further, numerous barriers to translational science have emerged among the nation's academic research centers, including basic structural and cultural impediments to innovation and collaboration, shortages of trained investigators, and inadequate funding.

To address these serious and systemic problems, in 2006, the National Institutes of Health created the Clinical and Translational Science Awards (CTSA) program, which aims to catalyze the transformation of biomedical research at a national level, speeding the discovery and development of therapies, fostering collaboration, engaging communities, and training succeeding generations of clinical and translational researchers. The authors report in detail on the planning process, begun in 2008, that was used to engage stakeholders and to identify, refine, and ultimately implement the

Correspondence should be addressed to Dr. Reis, University of Pittsburgh Clinical and Translational Science Institute, 3550 Terrace Street, Pittsburgh, PA 15261. Tel: 412-648-9516; FAX: 412-648-2741; sreis@pitt.edu.

Other disclosures: None.

Ethical approval: Not applicable.

Publisher's Disclaimer: The views expressed in this article are solely the responsibility of the authors and do not necessarily represent the official view of the NCRR or the NIH.

CTSA program's overarching strategic goals. They also discuss the implications and likely impact of this strategic planning process as it is applied among the nation's academic health centers.

Advances in human health are dependent on the translation of emerging discoveries in molecular genetics, cellular biology, stem cell research, and other basic biomedical disciplines into clinically important applications, and on the effective societal deployment of proven applications to clinical practice. Translation of discoveries is a bidirectional process: development of innovative strategies for the prevention, diagnosis, and treatment of human diseases requires that observations from patient-oriented, community-based, and public health research inform experiments in basic science laboratories. However, the conduct of bidirectional translational research is becoming more challenging because of the increasing complexities of both the basic and clinical sciences and the regulatory requirements for study conduct and marketing approval. In addition, a myriad of barriers to translational research have arisen, including the structural organization of traditional academic health centers, academic cultural impediments to collaboration, a shortage of translational investigators, the absence of mechanisms to facilitate translational research, and inadequate financial support.¹ The National Institutes of Health (NIH) catalyzed an effort to overcome these barriers on a national level in 2006 by creating the Clinical and Translational Science Awards (CTSA) program, which aims to develop and support the new discipline of "clinical and translational science."²⁻⁴ During the third year of the program, the National CTSA Consortium embarked on the development and implementation of a comprehensive strategic plan focused on an agenda that is best addressed in a national unified manner through the Consortium rather than at the local level at individual CTSA sites. In this article, we report the process and methods that were used, beginning in 2008, to develop the CTSA Consortium's strategic plan, which will serve as the roadmap for the reengineering of the national translational research enterprise.

The CTSA Strategic Planning Process

Building consensus

While strategic planning is generally best performed prospectively with an established and stable stakeholder pool, the CTSA strategic planning process had to take into account the dynamics of the program. Twelve CTSA sites were funded during each of the first two years of the program (see Table 1). The National CTSA Consortium's initiation of a comprehensive strategic planning process coincided with the NIH's announcement of the expansion of the program from 24 to 38 sites during year 3 of the CTSA program. These program dynamics required that the strategic planning process employ a stepwise approach. By necessity, this approach had to be designed by existing CTSA sites, but needed to include input from new sites that had not yet begun to implement their proposed transformative programs and did not have a comprehensive understanding about the organization and operations of the Consortium.

In April 2008, Stage 1 of the planning process began with the identification and prioritization of strategic goals by the principal investigators (PIs) from the first 24 CTSA sites and key NIH representatives. This approach was chosen because the PIs were responsible for leading the transformation of the research enterprise at their own institutions and therefore were positioned to determine how coordinated Consortium activities could supplement and leverage local efforts to transform the national research enterprise. The PIs agreed on four fundamental principles to guide this process:

- Consortium goals should focus on areas that could not be addressed by individual sites alone or by regional CTSA consortia.
- Education, training, and career development for clinical and translational scientists should serve as a cornerstone of the CTSA program.

- The Consortium should identify process issues that are common barriers to research at CTSA sites and develop “best practices” to facilitate the conduct of clinical and translational research across the United States.
- The CTSA should serve as a federated network to conduct multi-site clinical and translational research studies to optimize the efficiency of core facilities, to develop research tools, and to engage common stakeholders (e.g., lay community, industry).

Based on these fundamental principles, an iterative survey of the initial 24 PIs was conducted to identify and prioritize eight strategic goals. Further discussion among the PIs refined these goals and identified four additional goals (see List 1).

Facilitation of the planning process

The addition of 14 CTSA sites in June 2008 resulted in a working group of 50 Consortium members representing 38 academic institutions and the NIH Clinical Center, as well as NIH leaders and staff members. The large size of this group increased the logistical complexities of the strategic planning process. Anticipating needs for full stakeholder participation and consensus development, the Consortium contracted with Scintellix LLC (a biomedical consultancy that supports institutional strategic planning and goal execution) to facilitate the strategic planning process. The first facilitated planning meeting of the Consortium Executive Committee (10 PIs + 4 NIH representatives) was held in July 2008 to draft a mission statement for the Consortium, to develop a CTSA governance structure, and to refine, define more precisely, and distill the previously identified goals to a set of nine new goals, described below.

- *Continuous quality improvement (CQI): Clinical research management system.* Goal: To develop a system of continuous quality improvement for clinical research management processes, including programs focusing on IRB, contracting and grants management processes, development of process metrics, reimbursement for research procedures, mechanisms for study recruitment, and clinical site organization.
- *Federated career support.* Goal: To develop a coordinated approach to training, education, and career development in all aspects of clinical and translational science. Key features include efficient training of emerging investigators, standardization of clinical and translational research education, team building and management, development of guidelines for promotion policies for translational scientists, and enhancement of interactions between basic and clinical scientists.
- *National resource inventory.* Goal: To create a national searchable and interactive inventory of resources for clinical and translational research, including an inventory of technologies and services. Nested in this goal is the creation of a national biobank (i.e., systematic and accessible collection of biospecimens for common access and use).
- *Clinical trial “network of networks.”* Goal: To develop a proof of principle approach through several examples of inter-CTSA site networks for the conduct of clinical trials. These examples will serve as the foundation for the CTSA Consortium “network of networks,” with each network focusing on specific diseases or conditions, and with the networks being linked by common data systems and informatics tools.
- *Data-sharing network.* Goal: To develop a national system of electronic data management and data sharing complemented by information technology tools. Key features of this goal include development of a common, searchable website for data storage and sharing, development of a common informatics infrastructure, and development of consortium-wide data sharing policies.

- *National phenotyping system.* Goal: To develop a national phenotyping system, which requires establishment of phenotyping standards, informatics solutions, and data broker and access mechanisms.
- *National model for community engagement.* Goal: To develop effective national models for community engagement. Models should consider community-based participatory research, identification of health disparities, public input in the delineation of unmet medical needs, sharing of best practices, interfaces with practicing community physicians, increasing public trust, public education, identification of creative financial sources for community-based research, and leveraging ongoing efforts of NIH and other federal agencies.
- *Social networking initiative.* Goal: To develop a Consortium-wide social networking initiative that facilitates “matchmaking” among scientists, trainees, and mentors. This initiative requires an informatics solution and its development timelines.
- *Catalyze improved health through research.* Goal: To support regional and national health care reform. This goal requires the development of guidance for research initiatives, collection of evidence to support health policies, public policy engagement, and a focus on effectiveness of research as it deals with health care.

Engagement of stakeholders

Stage 3 of the strategic planning process was designed to engage all stakeholders in the Consortium in the streamlining and consolidation of the nine strategic goals, to identify organizational improvements that are required to align Consortium and site-specific activities with the strategic goals, and to begin to develop a comprehensive implementation plan. To seek broad input, the CTSA Steering Committee convened a Consortium-wide meeting in October 2008 that included 112 CTSA PIs, chairs of CTSA Consortium-wide key function committees (e.g., Informatics, Community Engagement, Evaluation), CTSA administrators, NCRR CTSA program leaders and staff, and other NIH representatives.

The planning meeting began with a single group session that resulted in modification of and agreement on the final CTSA mission statement: “*To improve human health by transforming the research and training environment, thereby enhancing the quality and efficiency of clinical and translational research*”. A modified Hoshin facilitation process⁵ was then used to refine, delineate, and prioritize the nine previously identified strategic goals. The Hoshin process is a well-established strategic planning technique that is especially effective in large disparate groups. To maximize the sharing of ideas through active group participation, meeting participants were divided into nine subgroups based on the previously identified strategic goals. Each group was led by two trained facilitators who implemented steps of a modified Hoshin process:

1. Mission creation—a 5-year mission statement was created for each strategic goal.
2. Idea generation—parallel ideation, idea clustering and priority assignment were performed to identify critical implementation steps, their timelines, and the degree to which progress has been achieved thus far.

During this process, the strategic goals were further refined. Although all nine goals were deemed to be important to the CTSA mission, four main goals were constructed to illustrate the critical strategy of the CTSA Consortium. The final four CTSA strategic goals, their subgoals, and their mission statements are described below.

Strategic Goal 1—Enhancing the national capability for clinical and translational research

This goal has three subgoals:

- *CQI clinical research management system*: To establish innovative, dynamic and transparent systems that will promote efficiency, quality and safety in the conduct and life cycle of clinical and translational research within individual CTSA institutions and across the National Consortium in five years.
- *Enhancement of national clinical study capability*: To create links and common processes across CTSAs to amplify clinical study implementation and impact.
- *National phenotyping*: To develop appropriate standards and methods for phenotyping health and disease to facilitate clinical and translational research.

Strategic Goal 2—Enhancing the training and career development of clinical and translational scientists

This goal is to develop a national coordinated approach to recruit, educate, train and promote the development of investigators across the evolving spectrum of clinical and translational research.

Strategic Goal 3—Enhancing Consortium-wide collaborations

This goal has three subgoals:

- *National resource inventory*: To catalog existing specialized resources throughout the CTSA that will be available to all investigators, and to identify areas where new resources are needed to accelerate clinical and translational research and to improve human health.
- *Data-sharing network*: To create data sharing mechanisms to facilitate innovation and collaborative research across the Consortium.
- *Social networking initiative*: To build infrastructure to connect people and to promote and support collaborative multidisciplinary clinical and translational research.

Strategic Goal 4—Enhancing the health of our communities and the nation

This goal has two subgoals:

- *National model for community engagement*: To identify and develop effective partnerships between academic researchers and community stakeholders that allow for participation, discovery, application and dissemination of science that improves the public's health and reduces health disparities.
- *Inform public health policy through research*: To strengthen the scientific foundation of public policy and, consequently, to improve public health.

The Strategic Plan's Implementation

Consortium agreement on the four strategic goals provided a framework for the realignment of existing Consortium-wide initiatives and the development of new initiatives that focus on achievement of the CTSA mission. Prior to embarking on the strategic planning process, the CTSA program formed 15 committees, each of which focused on a CTSA key function (e.g., informatics; study design, biostatistics, and clinical research ethics; child health) and included representatives from each CTSA site and the NIH (see List 2). In turn, these committees developed 83 task forces to focus on specific topics. Overall, this structure included more than 2,000 individuals. During the first two years of the CTSA program, these “key function committees” and their task forces identified topics and projects that they deemed would benefit from inter-CTSA collaboration and began to develop plans to focus on these projects. The committees essentially functioned independently from, and were not charged by, the CTSA PIs. Although this organizational structure resulted in productive committees of content-area

experts that made substantial progress in specific topic areas, it also led to an uncoordinated and largely underfunded effort that was dislocated from the CTSA PI Steering Committee's process of setting priorities for the Consortium.

After the National Consortium identified its four strategic goals, it became apparent that mapping of the key function committees and subsequent coordination of their effort was the critical first step in the implementation of the Consortium's strategic plan. To achieve the Consortium's goals, four "strategic goal committees" were created. These strategic goal committees, each of which consists of a minimum of three CTSA PIs, three CTSA administrators, and one member of the NIH staff, have been charged by the CTSA PI Steering Committee to develop and implement specific plans to achieve the Consortium's strategic goals. These plans require the identification of relevant expertise in, coordination among, and charging of the 15 key function committees. They may also involve the development of additional multidisciplinary task forces that include members drawn from different key function committees. For example, the social networking subgoal may require the development of a task force of domain experts drawn from the informatics, communications, education and career development, evaluation, and CTSA administrators key function committees. It is anticipated that this process will require systematic evaluation, reorganization, and likely absorption of key function committees into those designed to address the CTSA strategic goals. Consortium-wide resources will be focused on the four key goals to insure that the CTSA Consortium meets its objectives and milestones.

In addition to managing the transition of the key function committees to work in support of the prioritized aspects of the strategic plan, the strategic goal committees are evaluating implementation steps identified during the Hoshin planning process. These tactical steps were provided to the strategic goal committees to guide the development and stratification of immediate and longer range execution steps. As an example, List 3 illustrates specific implementation steps that were identified for the goal, "Enhancing the Training and Career Development of Clinical and Translational Scientists." Each strategic goal committee is using this type of information in the development of their implementation plans. This ongoing implementation process includes the identification of the scope of their strategic goal and prioritization of their subgoals, identification of which key function committees should be engaged, coordinated, and/or reorganized to achieve their goal, development of charges to relevant committees, and design of communications strategies to inform the Consortium about their progress.

After the four committees initiated their plans to address the Consortium's strategic goals, it became evident that the strategic plan did not fully address the inherent challenges of T1 translational research (i.e., the continuum of translational research in which laboratory-based scientific advances are translated into mechanistic studies in humans in pursuit of applications relevant to the improvement of human health). For example, T1 trainees are required to have a more substantial exposure to basic science as compared to other clinical and translational scientists, and T1 research requires the integration of basic technologies (e.g., genomics, proteomics, metabolomics, computational biology) with clinical and molecular data. Accordingly, the Consortium adopted a T1 Translational Research Goal as its fifth strategic goal to (1) develop education and training requirements for T1 investigators, (2) encourage collaborative demonstration projects that will to develop infrastructure for proof-of-concept studies in humans across different CTSA sites, and (3) develop efficient, effective and consistent models of technology transfer.

Implications of the CTSA Strategic Plan

The NIH established the CTSA program in 2006 as a transformative national initiative to develop and to advance clinical and translational science as a distinct academic discipline. The transformation catalyzed by the CTSA has already resulted in fundamental changes at the 46 academic health centers (and their partners) that have been funded by this program to date. Examples include innovative approaches to training, the performance of research, the streamlining of clinical research management, and to health practice and community engagement. However, the full potential of the CTSA program to improve human health by transforming the research and training environment can only be achieved by leveraging the collaboration among these 46 (and, eventually, 60) institutions and the NIH as a National CTSA Consortium.

The CTSA planning process is unprecedented in both its projected inclusion of 60 major academic health centers and the NIH, and in its scope. The resulting CTSA strategic plan has five main goals: Enhancement of (1) the national capability for clinical and translational research, (2) the training and career development of clinical and translational scientists, (3) Consortium-wide institutional and scientific collaborations, (4) the health of our communities and the nation through the conduct of clinical and translational research, and (5) T1 translational research. This plan, which has been embraced by each of the 46 CTSA institutions and the NIH, serves as the roadmap to harness the creative transformations at CTSA institutions across the country for the purpose of reengineering the national clinical and translational research enterprise. Implementation of this plan will result in the development of a trans-institutional mechanism to facilitate research and health advances that would not otherwise be possible. The NIH's commitment to the CTSA strategic plan is demonstrated (1) by its funding commitment as part of the American Recovery and Reinvestment Act of 2009 to support several CTSA administrative supplements that specifically focus on the development of methods to implement the CTSA Consortium's plans to achieve its five strategic goals and (2) by two large-scale grants to enable the national networking of scientists and resource discovery.

During year 4 (2009), Consortium-wide initiatives were being developed in parallel to coordination of programs among small groups of CTSA institutions, including efforts that stem from regional collaborations. These self-assembled consortia provide opportunities for geographically-centered inter-institutional interactions to leverage resources among CTSA sites. For example, these consortia can provide regional training opportunities, facilitate networking among trainees and scholars, develop novel methods for local dissemination of research findings, facilitate access to specialized resources, and provide a framework to conduct multi-site clinical trials within a geographic region. These regional groups plan to share best practices to guide the development of CTSA Consortium-wide programs to achieve the five strategic goals.

Lessons Learned

The CTSA strategic planning process has demonstrated the effectiveness of a facilitated approach to consensus development among member institutions of the National CTSA Consortium. Within six months, 38 academic health centers collaboratively identified, refined, and implemented plans to achieve five overarching strategic goals for the CTSA program. Implementation of plans among the current 46 CTSA institutions will transform the national research enterprise to meet the NIH's vision for the CTSA program. The planning process has made it clear that the success of the CTSA program is dependent on the collaboration of institutions to jointly increase research efficiency, train and support a new cadre of scientists, and, ultimately, to develop a new academic discipline of clinical and translational science.

Acknowledgments

The authors acknowledge the editorial assistance provided by Jonathan McCall.

Funding/Support: The CTSA strategic planning process was made possible by grant # 1UL1 RR024153 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research.

References

1. Pober JS, Neuhauser CS, Pober JM. Obstacles facing translational research in academic medical centers. *FASEB J* 2001;15:2303–13. [PubMed: 11689456]
2. Zerhouni EA. Translational and Clinical Science -- Time for a New Vision. *NEJM* 2005;353:1621–3. [PubMed: 16221788]
3. Zerhouni EA. US Biomedical Research: Basic, Translational, and Clinical Sciences. *JAMA* 2005;294:1352–8. [PubMed: 16174693]
4. Califf RM, Berglund L. Linking scientific discovery and better health for the nation: The first three years of the NIH's clinical and translational science awards. *Acad Med* 2010;85:-----.
5. Johnson PC, Mikos AG, Fisher JP, Jansen JA. Strategic directions in tissue engineering. *Tissue Eng* 2007;13:2827–37. [PubMed: 18052823]

Table 1

Clinical and Translational Science Awards (CTSA) Sites Funded in the First Four Years of the Program

CTSA site	Principal investigator
CTSA sites funded in 2006	
Columbia University	Henry Ginsberg
Duke University	Robert Califf [†]
Mayo Clinic	Robert Rizza
Oregon Health & Science University	Eric Orwoll
The Rockefeller University	Barry Collier
University of California, Davis	Lars Berglund [†]
University of California, San Francisco	Joseph McCune [*]
University of Pennsylvania	Garret FitzGerald [†]
University of Pittsburgh	Steven Reis [†]
University of Rochester School of Medicine and Dentistry	David Guzick ^{*†}
University of Texas Health Science Center at Houston	Frank Arnett [*]
Yale University	Robert Sherwin
CTSA sites funded in 2007	
Emory University (partnering with Morehouse School of Medicine and Georgia Institute of Technology)	David Stephens
Case Western Reserve University	Pamela Davis
Weill Cornell Medical College (partnering with Hunter College)	Julianne Imperato-Mcginley
Johns Hopkins University	Daniel Ford [†]
University of Michigan at Ann Arbor	Daniel Clauw [*]
University of Texas Southwestern Medical Center at Dallas	Milton Packer
University of Chicago	Julian Solway
University of Wisconsin – Madison	Marc Drezner
University of Iowa	Gary Hunninghake [†]
University of Washington	Mary Nora Disis
Vanderbilt University (partnering with Meharry Medical College)	Gordon Bernard [†]
Washington University	Kenneth Polonsky
CTSA sites funded in 2008	
Albert Einstein College of Medicine (partnering with Montefiore Medical Center)	Harry Shamon [†]
Boston University	David Center
University of Colorado Denver	Ronald Sokol
Harvard University	Lee Nadler
Indiana University School of Medicine	Anantha Shekhar
The University of Texas Health Science Center at San Antonio	Robert Clark
The University of North Carolina at Chapel Hill	Etta Pisano
Northwestern University	Philip Greenland

CTSA site	Principal investigator
The Ohio State University	Rebecca Jackson [†]
The Scripps Research Institute	Eric Topol
Stanford University	Harry Greenberg
Tufts University	Harry Selker
The University of Alabama at Birmingham	Lisa Guay-Woodford
The University of Utah	James Kushner
CTSA sites funded in 2009	
University of Arkansas for Medical Sciences	Curtis Lowery
University of Illinois at Chicago	Theodore Mazzone
University of Cincinnati	James Heubi
University of Florida	Peter Stacpoole
Mount Sinai School of Medicine	Hugh Sampson
New York University School of Medicine	Bruce Cronstein
Medical University of South Carolina	Kathleen Brady
University of Texas Medical Branch	Allan Brasier

* Was serving as principal investigator at the time of initial funding.

[†] Member of CTSA National Consortium Steering Committee at the time of initiation of the strategic planning process. Additional steering committee members representing the National Institutes of Health include Anthony Hayward (ex officio), Franziska Grieder, Karen Huss, and Walter Koroshetz.

List 1**Initial Strategic Goals of the National Clinical and Translational Science Awards (CTSA) Consortium***

- 1** Develop a system of continuous quality improvement in clinical research management (e.g., streamline and develop uniform processes for IRBs, contracts, grants management, Medicare and insurance payments, and clinical site organization).
- 2** Develop a coordinated/federated approach to career development, training, and education across the spectrum of translational and clinical disciplines.
- 3** Create a national, searchable, and interactive inventory of resources for translational and clinical research that includes people (e.g., clinical investigators, statisticians), technologies (e.g., genomics, proteomics), and services (e.g., data coordination, bioinformatics).
- 4** Develop a proof-of-principle approach through several clear examples of networks for subject accrual and conduct of clinical trials that will eventually result in a CTSA Consortium “network of networks,” each focused on a particular disease or condition, but linked by common data systems and informatics.
- 5** Develop a national system of electronic data management and data sharing, complemented by information technology tools.
- 6** Develop a national biobank.
- 7** Develop a national phenotyping system.
- 8** Develop an effective national model for community engagement.
- 9** Develop a conflict-of-interest policy that would be adopted as a “best practice” by all Consortium sites.
- 10** Develop a social networking initiative to link scientists across the Consortium.
- 11** Support regional and national health care reform.
- 12** Develop a coordinated national comparative animal model core and tissue biorepository.

* These goals were developed by an iterative survey of, and subsequent discussion among, the first 24 CTSA principal investigators of the strategic planning process, which began in April 2008.

List 2**Clinical and Translational Science Awards (CTSA) Key Function Committees***

- CTSA Steering Committee
- Child Health Committee
- CTSA Administrators
- Biostatistics, Epidemiology, and Research Design
- Clinical Research Ethics
- Clinical Research Management Task Force
- Communications
- Participant and Clinical Interactions Resources
- Regulatory Knowledge
- Community Engagement
- Education and Career Development
- Evaluation
- Informatics
- Public-Private Partnerships
- Translational Committee

* In 2008, prior to embarking on the strategic planning process, the CTSA program formed 15 committees, each of which focused on a CTSA key function (e.g., informatics; study design, biostatistics, and clinical research ethics; child health) and included representatives from each CTSA site and the National Institutes of Health.

List 3

Implementation Steps and Requirements for the Strategic Goal, “Enhancing the Training and Career Development of Clinical and Translational Scientists”^{1*}

- 1 Develop core competencies for clinical and translational investigators.
 - Develop overarching framework for core training in clinical and translational science.
 - Develop set of core competencies for trainees and graduates of clinical and translational research training.
 - Define new skills that need to be developed.
 - Develop standardized credentialing and certification criteria for clinical and translational investigators.
- 2 Continually improve trainee and program success.
 - Establish common conflict of interest policy.
 - Identify institutional homes for clinical and translational science within traditional academic structures.
 - Develop process to “retrain” established researchers to focus on translational science.
 - Develop and track short and long-term career outcome measures relevant to human health.
 - Measure self-efficacy.
 - Measure effect of clinical and translational research training on clinical and translational research.
 - Develop mechanism for CTSA sites to share programs, experiences, and outcomes.
 - Agree to use evidence from evaluations to adapt training programs.
 - Develop evidence-based understanding of what effectively promotes career development and success.
 - Refine approaches to interdisciplinary training.
- 3 Ensure that institutions recognize that clinical and translational investigation is a valuable enterprise with unique metrics and criteria for success and promotion.
 - Develop suggested national criteria for redefinition of academic promotion policies and requirements for clinical and translational scientists (policies must support team research).
 - Identify benchmarks and timelines for promotion policies for clinical and translational scientists.
 - Identify reward gaps in migrating a career between basic and clinical research.
 - Develop program to educate deans and department chairs about the new field of clinical and translational science.
- 4 Develop policies and mechanisms for support for investigators across the spectrum of their career development and the range of clinical and translational research.
 - Support development of additional funding sources for clinical and translational research training programs.
 - Develop consistent NIH K and CTSA KL2 award policies.
 - Develop trans-NIH institute funding mechanisms for transition of trainees to independence.
 - Ensure availability of adequate funding for trainees once trained.
 - Create CTSA KL2 award that has flexibility and accountability, and leverages other available resources.
 - Career development support: Develop recommended policies for NIH and other funders to provide predictable, clearly understandable, and competitive pathway to support careers of clinical and translational scientists.
 - Engage in business development efforts to recruit sponsorships for training programs in order to address existing gaps in training and career development
 - Develop loan repayment programs.
 - Develop new first award grants for clinical investigators.

- 5 Establish core curriculum that will address the needs of clinical and/or translational investigation.
 - Develop common core curriculum for clinical and translational scientists, including training in public/private partnerships.
 - Develop agreements needed for institutions to share curricula and programs.
 - Standardize and structure mechanisms to support multi-institutional research.
 - Develop team-building curricula germane to clinical and translational research.
 - Collaborate with education professionals.
 - Develop Web-based common tools for translational research that are available to trainees and investigators.
- 6 Develop effective training and reward mechanisms for mentors.
 - Develop funding mechanism to support time and effort that mentors devote to mentees.
 - Develop comprehensive training program for mentors.
 - Share best practices in mentoring.
 - Develop framework and associated tools for identifying, training, incentivizing, and supporting effective research mentoring.
- 7 Develop and promote a team-building approach to research.
 - Develop and test novel methods to engage and train non-clinician researchers in team science.
 - Develop institutional recognition and incentives for non-PI team members.
 - Create team structures as part of training process.
 - Create training structures that promote team-based research management skills.
- 8 Develop collaborative approaches to external partnership.
 - Develop collaborative approaches that require external partners.
 - Develop and promote team-building approach to research.
- 9 Recruit outstanding trainees to clinical and translational research.
 - Develop marketing strategies to attract trainees into a career in clinical and translational research.
 - Identify reasons why clinical and translational research is a good career choice.
 - Develop plan to recruit diverse trainees.
 - Coordinate and leverage existing training programs.
 - Develop set of strategies that encompass best practices (both nationally and locally) for recruiting potential investigators across the developmental spectrum.

* The list illustrates specific implementation steps that were identified for the stated goal through the Hoshin planning process. Each strategic goal committee is using this type of information in the development of their implementation plans.