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The Clinical and Translational Science Award (CTSA) Consortium and the Translational Research Model

Alexander A. Kon

University of California, Davis

The shift from isolated researchers working in their individual laboratories to diverse research teams working in collaboration towards a common goal is a fundamental element of the Clinical and Translational Science Award (CTSA) (<http://www.ctsaweb.org/>). What is often misunderstood, however, is the depth and breadth of the translational paradigm. The NIH Roadmap discusses two basic steps of translation. First, basic science research must be translated to humans (the so-called *T1 translation*), and then secondarily translated into clinical practice (*T2 translation*) (<http://nihroadmap.nih.gov/>). Further work has demonstrated that in fact this second phase of translation includes two separate steps, first knowledge from T1 translational studies must be translated to patients (T2), and then we must translate our knowledge into actual clinical practice (*T3 translation*) (Westfall et al. 2007). Closer scrutiny, however, reveals more complexity and the need for many levels of translation. In this essay, I will briefly outline some of the myriad levels of translation necessary, and provide some examples to illustrate why further work is needed at these levels. Further, I will briefly describe the CTSA Consortium and discuss how this new model of research is attempting to address some of these needs.

Translation takes many forms. If we start with a finding in a basic science laboratory that might have applications to the care of humans, such knowledge must go through many steps before it can have clinical applications. Basic scientific data must be translated into animal models, often this translation may start with non-primate mammals with subsequent translation into non-human primates. These pre-human experiments represent many layers of translation and require the collaboration of many scientists working in different research laboratories. Next, under the T1 translation, clinical researchers must assess the clinical applications in limited clinical conditions through controlled early-phase clinical trials. Next, knowledge from these early clinical experiments must be applied more broadly through phase 3 trials. Once clinical applications have been demonstrated through this T2 translation, clinicians must find ways to move these findings into the daily care of patient (T3). Merely translating findings to the actual bedside, however, is not enough. Moving scientific knowledge into the public sector and thereby changing people's everyday lives represents a major challenge (T4).

While many focus heavily on T1 and T2 translation, without T3 translation we cannot bring the benefits of medical research to individual patients. There exist many examples where despite excellent clinical research demonstrating clear benefit, individual physicians are slow to adopt best practices. One such example is the evidence that despite the clear benefits of statins in patients with elevated cholesterol, many patients for whom statins are indicated are not placed on appropriate therapy (Pasternak et al. 2002). Further, we must also translate scientific knowledge into people's everyday lives. Merely knowing that an intervention can

Address correspondence to Alexander A. Kon, MD, Associate Professor of Pediatrics and Bioethics, University of California, Davis, and Chair, Clinical Research Ethics Workgroup Task Force on Education, CTSA Consortium, NCCR, 2516 Stockton Boulevard, Sacramento, CA 95817. aakon@ucdavis.edu.

make people healthier is insufficient, we must also find ways to educate the general population and facilitate healthier lifestyles. Two obvious examples of the need for such T4 translation are smoking and obesity. Despite overwhelming evidence that both smoking and obesity are leading causes of illness and death, the rates of tobacco use and obesity remain alarmingly high. Developing strategies to facilitate better eating and exercise habits that actually translate into lower rates of obesity in the population, and creating programs that actually work to assist with smoking cessation and limit (or eliminate) the number of youth and non-smokers who start smoking would be a major advancement in public health and should be a chief research focus. Such T4 projects have the potential to dramatically improve public health and decrease medical costs. While such inquiry has historically been less glamorous than bench research, under the new translational paradigm, there will be more funding (and consequently more recognition) for such work.

Translation is a two-way street. Not only must we translate our scientific findings into the everyday care of patients and into the lives of the general population, we must also translate the concerns of the general population into scientific inquiry. In the past decades we have come to appreciate the importance of bringing clinicians into the research arena due to the unique perspectives of clinicians. Such collaborations have improved patient care through asking clinicians what would help them care for patients and using their input as the basis for scientific inquiry. Just as clinicians are often the best judge of what would help them in their practice, so too are members of the general population often the best judge of what would help them in their day-to-day lives. Empowering “everyday people” in developing research agenda will help the public have a voice in future directions of medical research. This “reverse translation” is an essential component of the CTSA as well.

Realizing the translational paradigm requires collaboration of many experts. The cooperation of basic scientists, clinical investigators, and clinicians is obvious. What is less apparent but equally necessary is the involvement of the general public, assistance from experts in bringing university researchers and the general public together, and cooperation with research directors and university administrators. Further, any such endeavor would fail without the inclusion of experts in statistics, research design, research oversight, data management, clinical research facilitation, program evaluation, education, and clinical research ethics. When one views the translational paradigm as necessarily bringing together such a broad range of experts, one sees why a shift to a translational model requires a complete redesign of the research endeavor.

The new translational model is the basis for the CTSA Consortium. In 2006, the National Center for Research Resources (NCRR, Bethesda, MD) funded 12 CTSA sites. In 2007, an additional 12 sites were funded with an ultimate goal of funding 60 CTSA sites across the United States (<http://www.ctsaweb.org/>). What makes the CTSA program unprecedented is both that it brings together experts in all fields listed previously at each CTSA institution, and that it brings together these experts from CTSA institutions across the United States together to form national committees and workgroups through the CTSA Consortium.

The benefits of intra-institutional collaboration are clear. Not only does such a system facilitate the collaboration of basic scientists, clinical researchers, clinicians, and community partners, it also ensures that researchers have access to much needed research support, including statistics, design, data management, and ethics, for example. Further, with educational programs under the CTSA framework, institutions are well positioned to train future investigators.

Equally important, however, are the inter-institutional collaborations. Through the CTSA Consortium, experts come together on national committees and workgroups. For example, the CTSA Clinical Research Ethics Workgroup (CREW) currently has three taskforces (Conflict

of Interest, Research Ethics Educational Materials, and Research Ethics Consultation) that are developing guidelines and tools for use on a national (and international) level (http://www.ctsaweb.org/committee.cfm?com_ID=15). Further, the CTSA Consortium facilitates multi-institutional research by bringing together investigators across the country with similar interests and common goals.

While some have questioned whether the move to a translational model may have negative consequences on scientific inquiry (Maienschein et al. 2008), clearly the CTSA Consortium promises a new direction. Breaking down the silos of academia, both within institutions and between institutions, may prove to be a major step towards improving the health of the general population. Translating science from the Petri dish to what people do in the privacy of their homes and back again is no small task. While asking for deliverables may change the way we do science, the move towards increased cooperation will only benefit science and the general public.

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