American Journal of Epidemiology
Published by Oxford University Press on behalf of the Johns Hopkins Bloomberg School of Public Health 2010.

Vol. 172, No. 5
DOI: 10.1093/aje/kwq214
Advance Access publication:
August 5, 2010

Response to Invited Commentary

Khoury et al. Respond to ''The Epicenter of Translational Science'': Crossing All the T's

Muin J. Khoury*, Marta Gwinn, and John P. A. Ioannidis

* Correspondence to Dr. Muin J. Khoury, Office of Public Health Genomics, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30333 (e-mail: muk1@cdc.gov).

Initially submitted June 3, 2010; accepted for publication June 8, 2010.

We agree with Dr. Hiatt that epidemiology belongs at the epicenter of translation (1), especially when integration of knowledge across disciplines is required to create the scientific basis for societal change. Although we recognize his concern that the ''proliferation of T's'' could get out of hand, we believe that our more granular description of translation helps to highlight epidemiology's role beyond the identification of risk factors (2).

Unfortunately, the thesis that epidemiology is at the epicenter of translation science is not universally shared. Although it is difficult to think of any medical progress that really saved lives and has not required a key contribution from epidemiology, no Nobel Prize has ever been awarded to an epidemiologist (3). In a recent 37-chapter authoritative textbook entitled *Clinical and Translational Science* (4), we had to wait until chapter 35 to read an introduction to epidemiology, which relegates the contributions of epidemiology to an afterthought in the translational sciences. One wonders whether the oft-lamented lack of successes in translational research is due to the lack of wider understanding of epidemiologic methods among researchers of diverse disciplines.

As Hiatt affirms, the point is that epidemiology has a central role throughout the translation continuum, regardless of what the overlapping phases are called. Epidemiologists come in all kinds of flavors. Some practice discovery research almost exclusively; others focus on development of evidence-based guidelines. Still more are engaged in clinical and public health practice, developing and implementing programs and measuring health impact at the national, state, and local levels. Their work is to measure factors that facilitate and impede the integration of proven interventions into practice (T3) and to assess the effectiveness of interventions in reducing morbidity and mortality at the population level (T4). Because both process and outcome measures are needed to evaluate interventions, T3 and T4 obviously overlap. Often T3 data are available years, if not decades, before T4 data, and the sources of data and methods used may differ. For example, surveillance systems are mainstays of public health programs that evaluate both process indicators, such as trends in the prevalence of cigarette smoking in the Behavioral Risk Factor Surveillance System (5), and outcome indicators, such as trends in lung cancer incidence using Surveillance, Epidemiology, and End Results (SEER) or state-based cancer registries (6). Many discoveries may look promising, managing to survive through T1 and T2 evaluations, and become widely accepted in medicine and public health only to be proven ineffective and harmful (7, 8). T3 assessments alone (collecting process indicators) would simply enhance wasted efforts, while T4 research can offer valuable hints that we have been misled and/or inform new discoveries (T0).

Our reason for highlighting T3 and T4 is not to create new niches or to divide disciplines but to spotlight epidemiology as a common thread along the entire translation continuum. Our quick review of the *Journal* publications suggests much less emphasis on T3 and T4 compared with discovery and early translation. Our bottom line is simple. The road to translation is long and arduous. We need to cross all the T's even though we may disagree on what to call them. Epidemiologists should play a much larger role in this enterprise in academic, clinical, or public health practice settings.

ACKNOWLEDGMENTS

Author affiliations: Office of Public Health Genomics, Centers for Disease Control and Prevention, Atlanta, Georgia (Muin J. Khoury, Marta Gwinn); Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, Maryland (Muin J. Khoury); Department of Hygiene and Epidemiology, University of Ioannina School of Medicine and Biomedical Research Institute, Ioannina,

Greece (John P. Ioannidis); Institute for Clinical Research and Health Policy Studies and Tufts Clinical and Translational Science Institute, Tufts Medical Center and Tufts University School of Medicine, Boston, Massachusetts (John P. Ioannidis); and Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts (John P. Ioannidis).

The opinions in this paper are those of the authors and do not necessarily reflect those of the US Department of Health and Human Services.

Conflict of interest: none declared.

REFERENCES

1. Hiatt RA. Invited commentary: The epicenter of translational science. *Am J Epidemiol*. 2010;172(5):525–527.
2. Khoury MJ, Gwinn M, Ioannidis JPA. The emergence of translational epidemiology: from scientific discovery to population health impact. *Am J Epidemiol*. 2010;172(5): 517–524.
3. Adami HO. Epidemiology and the elusive Nobel Prize. *Epidemiology.* 2009;20(5):635–637.
4. Arnett DK, Claas SA. Introduction to epidemiology. In: Robertson D, Williams GH, eds. *Clinical and Translational Science*. Amsterdam, the Netherlands: Elsevier; 2009:527–542.
5. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. (http://www.cdc.gov/brfss/). (Accessed June 3, 2010).
6. National Cancer Institute. State cancer profiles. (http://statecancerprofiles.cancer.gov/). (Accessed June 3, 2010).
7. Ioannidis JP. Why most published research findings are false. *PLoS Med.* 2005;2(8):e124. (doi:10.1371/journal.pmed.0020124).
8. Ioannidis JP. Evolution and translation of research findings: from bench to where? *PLoS Clin Trials*. 2007;2(2):e3. (doi: 10.1371/journal.pctr.0020003).