Editorial

Addressing behavioral risk factors in *Translational Cancer Research*

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Advances in genomics and related technologies have raised expectations of improved population-level benefits for cancer patients. Such improvements, however, will not be realized quickly if research remains in "omic" silos, a factor that prevents translation of discoveries into reductions in the burden of cancer (1). Although less than 15% of basic science discoveries are translated into clinical practice, a process that can take 17 years (2), current approaches to translational cancer research do not provide sufficient consideration to the range of influences, including behavioral risk factors, which are likely to affect population health. These factors, which contribute to the development and prognosis of cancer, have not been adequately considered. This deficiency may be due, in part, to varying definitions of translational research, conceptual and methodological challenges to conducting such research, and the poorly articulated role of behavioral sciences in translational research.

Could the accepted models of translational research have thwarted progress? If translational cancer research is to reach its potential, several questions must be addressed. How is translational research defined? Which models of translational research offer the greatest opportunity to integrate the study of behavioral risk factors for cancer? And how can the use of integrated models of translational cancer research be promoted?

How is translational research defined?

The definition can be elusive. The National Institutes of Health (NIH) recognize two areas of translation. One relates to "the process of applying discoveries generated during research in the laboratory, and in preclinical studies, to the development of trials and studies in humans"; the second focuses on "research aimed at enhancing the adoption of best practices in the community" (3). This tiered description of translational research gives rise to varying definitions and muddled perceptions among basic scientists, clinicians, public health researchers, and population-level evaluators (4,5). Fishbein *et al.* [2016] and others suggest that translational research may be conducted in as many as six stages (6). For some, translational research refers to the transformation of basic science discoveries into new drugs, devices, and therapies (i.e., bench to bedside). For others, it involves moving new treatments and interventions into practice settings (i.e., bedside to practice) (5). Still, others work to translate evidence-based knowledge into community settings, redesign systems, and develop and adopt policies that promote population health (i.e., practice to populations) (7,8). Despite the lack of agreement on a definition or on the number of phases in which translation research is conducted, its relevance to the mission and goals of the NIH is undeniable: "*to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability*" (9). The scientific community requires models of translation that reflect this purpose and expedite achievement of the mission and goals of the NIH.

Cancer researchers, who are at the forefront of translational science, are nevertheless generally engaged in 'siloed' pursuits. Gene expression can be modified by behavior, and behavioral factors are powerful contributors to cancer etiology, progression, and treatment (10). Despite evidence supporting the role of behavioral risk factors in the

sequelae of cancer, scientists are still failing to bridge the gap between research and practice.

Which models of translational research offer the greatest opportunity to integrate the study of behavioral risk factors for cancer?

For several decades, the linear, unidirectional model of translational research, which moves research findings in discrete steps from the laboratory through clinical trials into clinical practice and community settings has been predominant (11). The limiting assumptions of this model are that translation occurs in the later stages of the research continuum, and that investigation of behavioral risk factors occurs at the end of the process (12). Rubio *et al.* [2011] and Drolet and Lorenzi [2011] propose continuous bidirectional models of translational research, but these use frameworks that diminish the role of behavioral science, and behavioral and biomedical sciences are presented as independent components of translation (3,13).

In contrast, Hommel *et al.* [2015] offer a model of translational research that integrates biomedical and behavioral research and capture the potential for behavioral sciences to contribute broadly (14,15). Further, McBride *et al.* [2015] highlight the potential benefit of incorporating social and behavioral sciences into translational research (12). They note the limited role behavioral scientists have had in translational research and propose, for integration, two areas in cancer prevention, detection, and treatment: (I) effective communication to broaden dissemination of discoveries, including patient-provider communication and familial communication; and (II) the need to improve the motivational impact of behavior change interventions.

How can the use of integrated models of translational cancer research be promoted?

The National Cancer Moonshot (NCM) initiative, implemented by the NIH, illustrates a renewed purpose to advance translational cancer research. The goals of the NCM are to accelerate such research by (I) removing barriers to advances; (II) bringing more therapies to patients; and (III) improving cancer screening and early-stage detection, so that ten years of progress can be made in half the time (16). This timeline represents a remarkable change in the rate at which scientific discoveries are translated into clinical applications.

Federal agencies can exert leverage. The NIH has invested substantial resources into promoting translational research. The Clinical and Translational Science Award Program has expanded to about 60 academic medical institutions, and the Practice Based Research Networks of the Agency for Healthcare Research and Quality, which have a goal of translating research findings into practice, are now operative in all US states. Federal agencies must create and sustain additional processes and systems that support translational cancer research and provide the needed resources and tools. To sustain this effort, training programs should be funded to develop a cadre of researchers and clinicians who address the methodological, organizational, and conceptual challenges impeding the advancement of an integrated model of translational research.

Federally-funded initiatives alone, however, will be insufficient. If the field of translational cancer research is to fast-track progress in preventing, detecting, and treating cancer, shared leadership and teamwork among researchers will be needed. Thus, researchers must venture out of their 'silos' and create transdisciplinary research teams, and, as this journal has, editors and publishers must expand opportunities for the dissemination of knowledge that spans the field to highlight the importance of integrated translational research.

Conclusions

Moving research along the traditional translational continuum has failed to capitalize on the recent momentum in the basic sciences. Although behavioral factors are powerful contributors to cancer etiology, progression, and treatment, discoveries in the behavioral sciences that are germane to understanding, preventing, and curing cancer have received limited attention. To create an integrated, collaborative approach to translational cancer research, the concept must be broad, inclusive, and interactive. To accelerate the translation of scientific discoveries into improvements in population health, it is imperative to integrate research in the basic, clinical, and behavioral sciences.

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