The full translational spectrum of prevention science

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A new generation of research now demonstrates that individual differences in risk for psychopathology result from intrapersonal and environmental modulation of neurophysiologic and genetic substrates. This transdisciplinary model suggests that, in any given individual, the number of genetic variants implicated in high-risk behaviors and the way in which they are assorted and ultimately suppressed or activated by experiential and contextual factors will help to explain propensity and ultimate outcomes. Thus, risk can be amplified or reduced based on characteristics of an individual and his/her environment.

This emerging research generated by multiple disciplines has extraordinary potential for preventing behavioral problems and promoting resilience. Unfortunately, however, the relevant sciences continue to be overly silo'ed, for example, with researchers focusing on socio-emotional and contextual influences working independently from those studying neurobiologic and genetic processes. Recent trends, however, are responding to a burgeoning body of research on the brain and behavior, promising to increase integration of basic science into a holistic model of prevention research. And, near-futuristically, an end-goal is to guide development of new and innovative interventions and inform policy change. In essence, the state-of-the-science highlights the need for a transdisciplinary *and* translational model of prevention.

TRANSDISCIPLINARY TRANSLATIONAL MODEL

The proposed Special Issue seeks to promote the relevance, operational feasibility, and utility of a transdisciplinary translational model to guide prevention of behavioral disorders. This approach involves the proactive building of an empirical basis for practices and policies in that the science (1) incorporates neurogenetic mechanisms and interacting contextual factors; (2) recognizes early onset warning signs that underlie behavioral problems and later pathological outcome(s), (3) applies a transactional method to determine the developmentally and culturally appropriate intervention or policy to enhance protective mechanisms thereby reducing exposure to and impact of liability factors, and (4) is sensitive to adaptation across time and context.

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Information gleaned from this approach has great potential to elucidate mechanisms that protect individuals and communities from harm and foster systematic ways that researchers, practitioners, and policy-makers can work together to support improved interventions that benefit a greater number of individuals, families, and communities. In effect, our understanding of *what preventive interventions work best, for whom, why, and under what circumstances* will significantly advance.

THE TRANSLATIONAL PROCESS

Each paper of this Special Issue maps to six basic stages of translational prevention research proposed by the introductory paper. This translational process is neither linear nor circular; rather, each type, while primarily occurring as a stage in a progression (T0–T5), also may inform all of the other types. Back-translation—addressing outstanding questions to earlier phases in the translational process—applies at all stages. In brief, the stages are as follows:

- Type 0 captures the phenomenon of discovery in the basic sciences and the translational step is the development of an applied theory.
- Type 1 refers to the transfer of knowledge from the basic sciences to the applied sciences with the translational outcome being applied methods and program development.
- Type 2 translation embraces the applied strategies generated by T1 and aims to facilitate, in part, preparation for testing and establishing evidence-based or scientifically-validated interventions.
- Type 3 translational moves practices developed through T2 research beyond the academic research environment where efficacy studies are conducted and into clinical and community settings (where effectiveness and implementation studies occur) with a goal to reduce individual- and population-level behavioral health disorders.
- Type 4 translation formally acknowledges and categorizes the extant research base to understand how to move efficacious prevention programs into

a stage in which they are effective in clinical, non-research-oriented contexts and subsequently become self-sustaining in terms of fiscal subsidization, professional servicing, and infrastructure.

- Type 5 translation takes results at the local and national levels to alter our universal understanding of the key determinants of health and well-being and reform social systems to become more responsive to human needs based on sound and well-tested scientific evidence, taking into account global political, economic, and cultural variations.

Back-translation, an iterative part of the process, incorporates bidirectional exchange with earlier stages, as needed, so that there are constant modifications and refinements, allowing for continuous evaluation of outstanding questions.

The ultimate goal of this model is that, through a transfer of knowledge from etiology to practice and back to etiology, clinical and public health policies will be increasingly responsive and effective, thereby exerting greater reductions in behavioral health problems.

This Special Issue is organized around four major translational challenges: (1) demonstrating the utility of basic science findings for prevention; (2) formulating recommendations for the transfer of scientific information across the spectrum of translation, i.e., from basic research on “mechanisms of behavioral change” for practice and policy impact; (3) confronting the real-world challenges in applying a translational approach with recommended innovations to overcome existing obstacles and (4) coming full circle to develop methods and processes for effective prevention programs to be self-sustaining and use back-translational evidence to inform basic sciences.

As such, papers address the complex nature of a transdisciplinary approach to research that has inherent translational implications given that results may lead to the more effective prevention of high-risk behaviors. They do not simply convey data-driven results, but rather engage in telescopic thinking based on the status of the authors’ research and the next logical translational steps in the agenda. There is also discussion about what is needed to move the research to that future point across the translational spectrum and the means available to facilitate the application and eventual adoption of replicated results. In particular, obstacles are confronted that currently impede the transfer of results to the application and adoption of resultant interventions in the real world and new translational approaches to address them are delineated. Remedies include detailing transdisciplinary applications of systems science and innovative research techniques in the implementation and evaluation sciences, as well as enhancing the communication between researchers and communities (e.g., practitioners and policy makers) necessary for eventual acceptance and rigorous adoption. An early career investigator has coauthored each paper to provide an essential training experience in translation. In essence, the Special Issue

highlights how the transdisciplinary translational approach to prevention research can improve children’s and adolescent’s chances for growing up healthy and being afforded the opportunities to succeed in life in multiple domains.

ORGANIZATION OF THIS SPECIAL ISSUE

The introductory paper presents the full spectrum of a translational model specifically designed for the field of prevention. An exemplar of the translational process is provided by describing etiological underpinnings of callous-unemotional traits and then futuristically walking through the translational steps to apply this knowledge to development of potentially novel interventions, implementation, scaling and eventual globalization and enlightenment of public perceptions of the problem. The remaining papers are organized as follows.

Translational system supports

Hassmiller et al. illustrate how a systems dynamics framework can be used to advance research across each translational stage by integrating evidence and commonly isolated efforts of researchers, practitioners, and policy makers. The authors suggest practical methods such as collaborative system dynamics diagramming to support translational goals and improve outcomes from basic research to globalization. Moreover, the suggested methods allow for quantitative data that can be used to determine the best course of action, evaluate progress and outcomes, and improve or adjust translational efforts across disciplines and phases in the complexity of real-world issues.

Czajkowski and colleagues provide an NIH vantage point in highlighting the present challenges and barriers (e.g., conceptual, funding, supportive culture, training) of translational research in the context of the behavioral sciences. They also discuss the existing support systems of agencies that promote translational research. Drawing on examples of NIH-funded projects, several recommendations are provided to address each of the challenges in translational research. The authors further suggest movement toward unified frameworks and concepts that promotes the guidance and support of translational behavioral research across all phases of the translational spectrum.

Type 0: discoveries with import to prevention science

Vanyukov et al. present a novel conceptualization of translation-oriented biomedical research that suggests a shift from the current mainstream risk factor perspective of addiction to a resistance factor perspective. The purposed resistance concepts and implementation framework offer a basic scientific foundation as well as a logical transition to applications in addiction prevention and intervention (that is, T0 to T1). The authors discuss a methodological framework that

implements the resistance perspective and the reversal of research perspectives in addiction sciences.

Type 1: translation of basic and applied theory and findings to interventions

Szyf et al. consider the malleability of DNA methylation in the context of type 1 translational research science and its potential to be used in epigenetically targeted interventions. The authors also suggest utilizing DNA methylation markers as assessment tools for individual risks as well as measuring the progress of an intervention. Additionally, the challenges of transforming behavioral epigenetics into “translational epigenetics” are recognized and discussed.

Tang and Leve review relevant neuroscience and psychological research on the effects of meditation and propose a translational prevention model of mindfulness. The suggested framework applies the underlying neuroscience that explains the effect of mindfulness on behavior and emotions to potential clinical practice (T1 translation). The authors call for further type 1 research on the potential preventive impacts of mindfulness.

Type 2: translation of program development to implementation

Gewirtz and colleagues present research that embraces applied strategies and seeks to facilitate preliminary testing of evidence-based interventions (i.e., T1 to T2). The authors explore the feasibility of using doubly randomized preference trials to examine preference rates of parents for different treatment formats for children with conduct problems. Results suggest that providing client choices may be feasible and effective for increasing family commitment to mental health services for children.

Thibodeau et al. discuss the application of differential sensitivity theories to account for the variability in developmental pathways that interact with prevention outcomes. The authors suggest that measuring sensitivity as a phenotype may help clinicians to decide what type or dose of intervention is appropriate for optimized outcomes—contributing to reduction in intervention costs, burden, and stigmatization. However, the authors recognize the need for further development and testing of differential sensitivity approach and present recommendations for continued evaluations.

Type 3: translation from effectiveness work to evaluation and acceptance

Graham et al. present a conceptual framework that integrates culture and diversity throughout each stage of the translational science process (T1 through T5). The authors discuss the challenges and strategies for applying this framework in the context of each translational stage. Suggested strategies include engagement with participants as “citizen scientist” across the translational stages and implementation review boards to facilitate and inform appropriate elements of culture and diversity.

St. George and colleagues followed the progress of the Familias Unidas, an evidence-based, family-centered prevention intervention that crosses translational stages type 1 through type 3. The results highlight the importance of monitoring and ensuring program fidelity and the use of various program metrics. The authors suggest that community practitioners, researchers, and policymakers rely on observational methods to ensure the fidelity of translational interventions.

Chiapa et al. examine the validity of the parental monitoring and family problem-solving constructs in the context of evidence-based parent training interventions that target adolescents and families. Specifically, the researchers examine the efficacy and validity of using these constructs in culturally diverse groups (e.g. European Americans and African Americans). The authors suggest their findings contribute to the understanding of the parental monitoring and family problem-solving constructs across these groups and support effective clinical and community interventions.

Across three studies, Ridenour and colleagues demonstrate the flexibility, wide application, and rigor of idiographic clinical trials (ICT) for preliminary testing of intervention mechanisms based on statistical resources. The authors focus on novel uses of state-space modeling for testing intervention mechanisms of short-term outcomes, identifying heterogeneity in and moderation of within-person treatment mechanisms. The utility and limitations of ICTs in type 3 and type 4 translational science are discussed.

Type 4: translation to systematic dissemination, adoption, and institutionalization of prevention practices

Aldridge and colleagues address the gap between the required processes for successful and sustainable implementation and scaling-up of intervention programs and the real-world challenges for communities. The authors suggest methods from applied implementation science as a framework for type 3 through 5 translational science activities. The recommended framework includes collaborative engagement from community members to program developers to funders and policymakers; specific responsibilities and actions from stakeholders are highlighted given their potential to support the success of effective implementation.

Crowley and Jones discuss the role of economic analysis in prevention science. The authors present key translational research opportunities to meet growing demands for estimates of prevention’s economic and fiscal impact. The implications exemplify type 4 translational in which prevention programs can leverage fiscal and economic impact into self-sustaining public health programs.

Type 5: strategies to deconvolve interventions and translate globally

Komro et al. discuss the challenges of effective evaluation of type 3 to type 5 translational research such as

multiple contexts of evaluation/research, the complexity of packages on interventions, and the phases of evaluation/research questions. Moreover, the authors argue that T3 to T5 translational research efforts should include assessments of the reach, implementation, effects on immediate outcomes, and effects on distal health outcomes. The authors suggest multiple alternative research designs to address these challenges and highlight the need for standardized continuous measurement systems.

And lastly, Biglan and Levin posit that translational research places an insufficient emphasis on

the assessment of prevention's impact on the social determinants of psychological, behavioral, and physical disorders resulting in a failure to affect the incidence and prevalence of these disorders. Moreover, the authors suggest that translational research fails to consider broader components of intervention such as policy change, media, and cultural change movements. Building on these points, the authors discuss the success of the tobacco prevention movement over the last half-century and how other prevention efforts could benefit from these lessons of success.