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Adapting the Ideas of Translational Science for Translational Family Science

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Adapting the Ideas of Translational Science for Translational Family Science

Joseph G. Grzywacz and Jeffrey W. Allen *Florida State University*

Department of Family and Child Sciences, 225 Sandals Bldg., Florida State University, Tallahassee, FL 32306-1491 (jgrzywacz@fsu.edu).

Family science has been doing translational science since before it came into vogue. Nevertheless, the field has been subjected to the same forces in the broader academy that have created a widening chasm between discovery and practice. Thus, the primary objective of this article is to translate the principles, concepts, and models of translational science to solidify an identity for family science and help the field move forward in broader academic, care delivery, and policy arenas. Alternative models of translational science, primarily from biomedicine but also from other disciplines, are reviewed and critically analyzed, and core concepts and principles are isolated, elaborated, and applied to family science. Family science's long-standing commitment to the doctrine of evidence-based practice, and its ongoing endorsement of the principles of scientific duality and multidisciplinary utility, places it in a preeminent position for using the zeitgeist of translational science to move forward. Nonetheless, the field has important epistemological, practical, professional, and curricular steps to complete to better position itself as a distinct and valued body of scientists. Ultimately, we argue that embracing the principles, concepts, and models of translational science should be leveraged by family science to help brand itself as a unique and essential social science field for enhancing the human condition.

Key Words: Evidence-based practice, family science, research-to-practice, translational science.

Translational science is a dominant feature of the contemporary scientific and academic landscape. Its entry into the spotlight was driven by several converging factors, not least of which was the widening gap between research undertaken by the academy and the everyday needs of practitioners in the field (Butler, 2008). Indeed, the reality that it takes 17 years to move a scientific finding into evidence-based practice (Morris, Wooding, & Grant, 2011) suggests that many individuals have suffered needlessly while waiting for the process to unfold. Some in the biomedical field have referred to the temporal gap between a research finding and its implementation as the "valley of death" (Butler, 2008). But what does translational science mean to family science? Family scientists do not engage in drug development research with its layers of administrative and regulatory oversight, nor is family science driven by profit motives attached to patent or device development. Nevertheless, quality-of-life enhancements and associated protections to health and well-being run deep into the disciplinary roots of family science, suggesting that family science needs to attend to the 17-year lag between scientific discovery and the systematic implementation of that discovery to enhance quality of life.

Consistent with the spirit of this special issue, we contend that translational science is at the very core of family science's professional identity. Indeed, under the organizational guidance of the National Council on Family Relations (NCFR), family scientists have been doing translational science since before the term came into vogue in the early 2000s. However, family science has also fallen victim to the same widening research–application gap experienced by other disciplines, wherein research advancements have outpaced the transfer and translation of that knowledge into real-world impacts. Given the translational nature of family science, we agree with Zvonkovic's view (see Gavazzi, Wilson, Ganong, & Zvonkovic, 2014) that the

ascension of translational science can help address family science's identity problem. More specifically, we believe the theoretical ideas underlying translational science and its developing models and methods can be used to help family scientists navigate the discipline's interdisciplinary nature and its relationships with other disciplines. Further, consistent with Gavazzi et al.'s (2014) recommendations, we believe that the rapidly evolving domain of translational science can provide frameworks, nomenclature, and manners of doing business and branding to strategically guide how family science can move forward in broader academic, care delivery, and policy arenas.

The goal of this article is to translate the principles, concepts, and models of translational science for family science. To achieve this goal, we first provide an overview of how translational science ascended to its current position as a philosophy of science. This historical overview is instructive because it foreshadows key ideas underlying translational science, and it shows how challenges experienced in other disciplines parallel those of family science. Next, we outline the foundational meaning of translational science. Specifically, we isolate the key concepts and principles of translational science, and we exposit the meaning of translational science by outlining alternative models. The key reasons for covering this material are to dismiss the overly simplistic view that translational science is merely repackaging of applied science, to replace the false researcher–practitioner dichotomy with a more nuanced appreciation for different types of science, and to clarify that translational science is not simply translating scientific results into interventions. In the third and major section of this article, we translate the ideas of translational science for family science. Finally, we conclude with a high-priority set of activities to operationalize these ideas with the hope of dawning a new era of family science that

celebrates and leverages all forms of knowledge to enable greater ability to understand and strengthen families.

The Ascension of Translational Science

Translational science began entering the scientific lexicon in the 1990s but did not become a commonly used term until after the National Institutes of Health (NIH) implemented its Roadmap (see Zerhouni, 2003). The Roadmap was a strategic plan intended to overcome vexing challenges that impeded science's ability to understand and promote human health through three primary strategies: creating new pathways to discovery, developing research teams of the future, and reengineering the clinical research enterprise (Zerhouni, 2003). A key impetus contributing to the development of the Roadmap was the gap between basic research findings of biomedical researchers and the tools used by biomedical clinicians to treat human disease and alleviate human suffering. As Butler (2008) summarized, with substantially more grant funding available for basic research, academic researchers were incentivized through standard promotion and tenure requirements to focus their efforts toward going increasingly deeper into the realm of discovery. One consequence of increased specialization of basic research is that the audience for research results increasingly became other researchers, rather than clinicians who would apply those findings in everyday practice.

The scenery in the social sciences more broadly, and family science more specifically, is not dissimilar to what Butler described as the "valley of death." Communication between researchers who study basic family structure and processes through observational and experimental research designs are often far removed from clinicians. Just as individuals who provide direct care in the biomedical realm (e.g., physicians, nurses, physical therapists) are referred to as clinical scientists, we contend that *clinical scientist* is the appropriate term for

those who provide care (e.g., marriage and family therapists, family life educators, parent educators, family service agents) to children and families to promote quality of life through direct and indirect mediums such as educational programs and policy initiatives, respectively. Indeed, there are few places family practitioners can obtain sound research designed with sufficient specificity to inform the applied issues they encounter. When a plausibly relevant study is located, the content is likely conveyed using the jargon of theoretically based research because most journals are designed primarily for researchers to communicate. Moreover, neither the typical strategy for implementing observational research nor the typical lab-based study is well equipped to match the complexities confronted by practitioners working in the real world. The combination of jargon-filled pages that are often only loosely connected to the everyday reality of contemporary families leaves family practitioners confused and demotivated (Voosen, 2016). Indeed, a poignant comment made during the 2016 meeting of the *Family Relations* editorial board was that most attempts at the "Implications for Practice" section from researchers are narrow, out of step with reality, or naïve to the everyday reality of individuals working with families.

As in biomedicine, scholarly productivity in the social sciences, including family science, incentivizes the production of research products, such as peer-reviewed publications. Indeed, the weighted focus on producing research to advance in an academic career creates pressure to generate publications (Lemann, 2014) and a mind-set that once a study is accepted for publication, it is time to move on to another one. Disseminating and communicating research results to individuals who can act on them is typically left to chance or delegated to a university public relations office. There is very little deliberate effort given to sharing research results with family practitioners who work with the population studied.

Notably, in family science there are clear exceptions to the tendency to separate the worlds of research and practice, the most notable and institutionalized among them being Cooperative Extension. As described by the U.S. Department of Agriculture (n.d.), Cooperative Extension "emphasizes taking knowledge gained through research and bringing it directly to the people to create positive changes." There are other visible attempts to bridge research and practice. For example, many of the evidence-based programs underlying regional and national initiatives sponsored by the Administration for Children and Families are the manifestations of years of work to move research results to practice guidelines. Nearly a decade ago, Spoth (2008) published a paper titled "Translating Family-Focused Prevention Science Into Effective Practice: Toward a Translational Impact Paradigm," wherein he outlined a model for translating family research to practice and advocated several next steps for realizing that translational goal. Similarly, as the official practice-oriented journal of the National Council on Family Relations, *Family Relation*s requires implications for practice in all published manuscripts. Although these and other laudable exceptions exist, research and practice rarely comingle in family science.

Although very different disciplines, the history and current experience of family science tracks closely with the history and current experience of biomedicine. As Unger lamented more than 10 years ago during a meeting of an NCFR focus group on applied research, disparities in research funding for basic science and associated implications for publication and tenure decisions have outpaced resources and motivation for converting research findings into concrete strategies that benefit individuals or families. To the extent that form follows funding, it is understandable that many more family scholars commit themselves to research discovery rather than creating solutions that benefit people. Over time, basic differences in funding and human capacity between research and practice have created distinct cultures and distinctions between

highly valued in-groups and lesser-valued out-groups, resulting in barriers with regard to communication and interaction between the groups (Currie, El Enany, & Lockett, 2014). The NIH Roadmap and the concept of translational science was designed to break down the barriers between research and practice and enable the creation of new pathways to discovery by working collaboratively to develop research teams of the future, and thereby reengineer the research enterprise (Zerhouni, 2003).

Foundational Meaning of Translational Science

Translational science and its primary tool, translational research, is typically defined nominally. For example, one often-cited definition refers to a general process: "Effective translation of the new knowledge, mechanisms, and techniques generated by advances in basic science research into new approaches for preventing, identifying and treating disease is essential for improving health" (Fontanarosa & DeAngelis, 2003, 2133). Another definition offered to guide development and evaluation of training programs in translational science stated that "translational research fosters the multidirectional integration of basic research, patient-oriented research, and population-based research, with the long-term aim of improving the health of the public" (Rubio et al., 2010, p. 471). Still another definition described translational research as "activities designed to transform ideas, insights, and discoveries generated through basic scientific inquiry and from clinical or population studies into effective and widely available clinical applications" (Mitchell, Fisher, Hastings, Silverman, & Wallen, 2010, p. 293).

As these definitions make clear, translational science is conceived of as a process. Early conceptions of translational science differentiated research findings from basic or bench research and applied clinical research (Sung et al., 2003). In basic research, disciplines like biochemistry, physiology and pathology, and genetics are leveraged with the express intent of identifying

potential targets for preventing or treating disease. Applied research in the biomedical field refers to randomized clinical trials that are designed to determine the efficacy and effectiveness of clinical interventions like alternatives to diagnostic testing, new drug therapies, or ideal dosing strategies. In what was originally called the bench-to-bedside view, the main idea was that translational science would identify and eliminate blocks or barriers to transferring knowledge (i.e., results from basic or bench research) to human efficacy studies (the first phase of translation, or T1), and eliminate barriers to transferring knowledge from human efficacy studies to everyday clinical practice (the second phase of translation, or T2). The sum of translational science was fundamentally focused on identifying and eliminating barriers in these two bottlenecks presumed to impede knowledge transfer from science to practice.

The phases of translational science or the transfer of knowledge from basic scientific discovery to final impact continues to evolve. The most recent conception of the National Center for the Advancing Translational Sciences articulates five phases of translational research indicated through the use of *T* (for "translational phase") and the associated phase ranging from 0 to 4, including one phase reserved for purely nonhuman studies (T0). After basic research conducted in laboratories or with animal models, the first phase of translational research (i.e., T1) is the transfer of knowledge obtained from basic science into a potential intervention and subsequent efficacy trials to determine whether the manipulation produces the intended outcome under highly controlled circumstances. The next phase of translational research, T2 research, is the transfer of knowledge obtained from efficacy trials into effectiveness trials to determine whether the manipulation produces the intended outcome under loosely controlled (or noncontrolled) circumstances. In T3 research, the key feature of interest is transferring results obtained from effectiveness trials into interventions to change behavior on the part of the

individuals responsible for delivering the manipulation to produce the intended effect. In biomedicine, the key question is how to get the effective treatment into the hands of all health-care providers and make sure that treatment is used instead of something different. The interrelated fields of implementation and dissemination science frequently exist in the T3 space. Finally, the last phase of translational research (T4) is transferring research findings into community or public strategies that protect populations.

There are two features underlying most existing models of translational science, both those in biomedicine (e.g., Institute of Medicine, 2013) and adaptations in other disciplines, like social work (Brekke, Ell, & Palinkas, 2007), behavioral and social science (Lemon et al., 2014), and public health (Ogilvie, Craig, Griffin, Macintyre, & Wareham, 2009). First and foremost, knowledge is presumed to originate in the science of discovery, particularly discovery science at the most basic level. The notion that knowledge originates in research characterized by basic discovery is observable in the sequence underlying the progression of translational science wherein T0 is often seen as the starting point for translational ideas and implementation in practice is the final step (Brekke et al., 2007; Drolet & Lorenzi, 2011; Ogilvie et al., 2009). In some models the downstream consequences of practices, namely the burden of disorder or disease in the population, becomes the impetus for additional basic science (Lemon et al., 2014); however, most models of translational science are represented by a single left-to-right arrow whose origin lies in basic research and whose ultimate destination is practice. The second underlying feature of most models is that primary emphasis is on the transfer of knowledge from one step to the next. The most characteristic example in the bench-to-bedside view of translational science (Drolet & Lorenzi, 2011; Westfall, Mold, & Fagnan, 2007) is the challenge of physicians using the results from the most recent clinical trials to inform their prescription

patterns. There is little or no room in these discussions for whether that knowledge *should* be transferred or whether that knowledge is consistent with the knowledge, values, or preferences for the ultimate end target, in this case the individual receiving the prescription advocated by research. The assumption that basic knowledge obtained from research is universally accepted is a matter of epistemology, and as Middlemiss, Cowan, and Kildare (2017) make clear elsewhere in this issue, oftentimes transferred knowledge needs to be translated (and perhaps revised) into the epistemologies of others to achieve the desired outcome. Thus, the distinction between the transfer of knowledge and the translation of that knowledge is a salient but often overlooked feature of translational science.

Concepts and Principles of Translational Science

The description of translational science embraced in biomedicine reveals several basic concepts requiring definition and elaboration. The first fundamental concept is that of *translation*. According to the *Merriam-Webster Dictionary* (n.d.), to translate is "to convert something from one form into another." Perhaps the most common example of this is translation in communication among individuals who speak different languages: the words and meaning of the spoken language must be changed into another form to be understood by the listener. Science, according to the same online dictionary, is "the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical, natural, and constructed world through observation and experiment." When combined, the resulting concept (i.e., translational science) could be defined as the intellectual and practical activity of changing results obtained from the systematic study of the physical, natural, or constructed world through observation and experimentation into a usable or actionable form.

The biomedical models of translational science differentiate *stages of research* from the *phases of translation*. Just as in stage theories of human development, stages of research can be conceptualized as a period of research activity with discernable beginning and ending points in a domain of science that is characterized by similar methods (e.g., correlational and longitudinal designs) that are qualitatively distinctive from prior periods (e.g., descriptive, perhaps qualitative) or subsequent periods (e.g., intervention designs). Phases of translation are conceptualized as a transitory period wherein knowledge gained from one stage of research is translated or converted into the inputs needed in a subsequent stage of research or application. Thus, whereas *stage* connotes some modicum of stability, *phase* connotes a transitory location between two stages. Because of its connections with both family science and biomedicine, childbirth provides a good example of the distinction between stages and phases. Labor and delivery are two distinct stages of childbirth; the first is characterized in terms of bodily preparation (i.e., labor), and the second is characterized in terms of production (i.e., delivery). The first stage of childbirth is broken into three distinct phases characterized by cervix dilation; a vaginal birth cannot occur unless the phases are completed, thereby making delivery possible in the second stage of childbirth. Likewise, results from longitudinal research suggesting that *X* causes *Y* cannot be converted into an intervention study until a strategy for manipulating *X* is created or adapted.

The preceding definitions and concepts, including the differentiation of stages of research from phases of translation, display the underlying doctrine or belief system of translational science; that is, the doctrine of evidence-based practice. The doctrine of evidence-based practice is the belief system that the best strategy for achieving a desired outcome is one built through the purposeful sequencing of empirical observations obtained through scientific inquiry. The

doctrine of evidence-based practice is composed of four principles and one corollary (see Table 1), some of which are consistent with family science but others are not.

Applying the Ideals of Translational Science to Family Science

This final section defends the position that family science has been engaging in translational science before the concept entered the scientific lexicon, positing that translational science offers many useful tools for the discipline's future. We do this by first highlighting how the practical imperative creating the need for translational science is easily visible in family science. Next, we demonstrate parallelisms between the concepts, principles, and models of translational science with those of family science, and we discuss points where the principles of translational science diverge from those of family science. We conclude this section by offering a model of translational family science and by articulating an agenda that enables us to capitalize on our disciplinary preeminence in translational science and move forward as a cohesive discipline.

The Practical Need for Translational Science

Interestingly, Campbell (1969) anticipated the problem that translational science is attempting to resolve when he illustrated the problem of disciplinary ethnocentrism. Campbell argued that scientific disciplines and subdisciplines, like all people groups and associated cultures, tend to think and behave more similarly within groups than between groups. Over time, the similarities within disciplines grow and magnify dissimilarities across disciplines, resulting in scientific specialty areas that are clustered and frequently isolated from other specialty areas or disciplines. Thus, the increased specialization in research, the expanding chasm between research and practice (Butler's, 2008, valley of death), and the need for translational science (Zerhouni, 2003) are concrete manifestations of disciplinary ethnocentrism.

Figure 1 provides a modified version of Campbell's (1969) illustration of disciplinary ethnocentrism, personalized to family science. Some family scientists are interested in family matters related to population dynamics like fertility and migration, or socio-structural realities like shifts in economies, social structures, and technological advancement. Others are interested in interpersonal dynamics within families but divide their scientific space according to particulars like the nature of the interpersonal relationship (e.g., couple dynamics, parent–child dynamics) or the period in the life span of interest (e.g., social group and peer dynamics in children's social development, the influence of social networks and supports on adult aging). Still other family scientists focus on manipulations or interventions, sometimes in the realm of clinical treatment (e.g., marriage and family therapy, family nursing) and sometimes using a more generalized prevention or enhancement strategy wherein specific individuals or groups are targeted (e.g., family life education, parenting or coparenting education). And still others are interested in basic family processes (e.g., intergenerational transmission of behavior, physiological impacts of family stress) or in using generated science to create policy solutions that protect and support families. If the breadth of scholarly interests within the field reflects a full scientific understanding of families, then Figure 1 makes clear the gaps in scientific understanding resulting from disciplinary ethnocentrism within family science. It is these gaps that are the express focus of translational science in general and that signify the need for translational family science.

Figure 1 also highlights how challenges experienced in family science reflect broader issues in scientific advancement, at least scientific advancement motivated by the goal of improving the human condition. Similar to the bottleneck in converting results from advancements in basic science research into clinical intervention (Butler, 2008), there is also a

bottleneck in moving findings from the volumes of published research on basic family processes into solutions that benefit families and individuals—either through interventions in clinical contexts like marriage and family therapy clinics or through prevention contexts. The same criticisms motivate T3 research and the rise of practice-based research networks to more efficiently move evidence-based interventions into standard care. Many family scientists are clamoring for research addressing specific problems observed in clinics or by families in their lived experiences. As in other applied disciplines like public health, family science grapples with study designs that frequently disallow strong causal inference, collections of studies that use appropriate but inconsistent measurement or sampling strategies, or bodies of evidence that leave entire population groups invisible or underresearched. Given such messiness, movement into the T4 phase of science is often challenging because it is unclear which procedures or protocols should be used to convert evidence into guidelines for practice or recommendations for policies targeting families and who should be involved in rendering those decisions and recommendations.

Parallels Between Translational and Family Science

The principles underlying biomedicine's interpretation of translational science are instructive to family science. Most of the principles of translational science are clearly embraced by family scientists and its professional body (NCFR). As outlined by Harmon in this issue and elsewhere (Hamon & Smith, 2014), NCFR was built on the doctrine of evidence-based practice. Moreover, the ongoing commitment to research and practice is demonstrated by NCFR through its annual conferences open to both researchers and practitioners, dedicated journals to basic science and applied research, and strategic investment in family life education. Each of these commitments conveys acceptance of the principle that science produces knowledge, as well as the principle of

scientific dualism (i.e., the sciences of discovery and practice) and the associated corollary that bridge building is essential. Likewise, family science has long embraced the principle of multidisciplinary utility.

Even the principle of mechanistic understanding, which may be objectionable, is useful for guiding translational family science. We propose that family science reject the principle of mechanistic understanding because the discipline tends to emphasize the interaction of both individual agency and structural influences in the production of desired outcomes (often assuming an agency-within-structure position; see Settersten & Gannon, 2005). This opens the door to conversation as a discipline but nonetheless suggests that family science would replace the principle of mechanistic understanding with the principle of organismic understanding. That is, individuals and families cannot be understood by reducing them to basic elements like molecules, cells, or individual members. Rather, individual units (be they individual humans, families, or clusters of families) can be understood only holistically and as active creators of their reality. We, and others (see Middlemiss et al., 2017), see this perspective as a fundamental shift away from a focus primarily on knowledge transfer from one group to another (e.g., researchers to clinicians) to one that emphasizes both the transfer of knowledge from one group to another and the corresponding translation of the relative importance of the knowledge for the targeted group. Importantly, it is the scientists of practice who are often critical for transferring and translating the knowledge of families' everyday lives into the language used by discovery scientists.

Another instructive element of the biomedical perspective on translational science for family science is the parallelisms in the phases of movement from basic discovery to population impact. Although few family scientists work with basic molecules and animal models (i.e., T0

research), this does not mean that family scientists cannot engage in animal model research. Indeed, there is a substantial animal models literature focused on how physical and social stressors affect mating and parenting behavior, yet family scientists rarely contribute to this literature to test different theoretical ideas, nor do they typically draw on this literature to inform their research—an issue clearly illustrated recently in a special of *Family Relations* focused on the biosocial model of family science (Middlemiss, 2016). As with biomedicine, T1 research fundamentally involves basic research studies that produce results with potential value for informing interventions that may produce valued outcomes. Research that delineates variation in relationship satisfaction by discrete forms of resolving couple conflict, or studies of the longitudinal effects of parental monitoring on adolescent academic performance are examples of T1 research because they offer insight into practical strategies that have potential value for producing stronger families or enhancing quality of life. Like the model proposed by the Center for Advancing Translational Science, T2 research in family science is exemplified by the array of tightly controlled intervention studies ranging from basic psychoeducational strategies to promote relationship quality or coparenting among divorced couples, to alternative therapeutic strategies for helping couples recover from infidelity. Similarly, loosely controlled interventions, such as those done in real-life settings like Cooperative Extension, are illustrative of T3 research. Finally, the activities undertaken under the broader auspices of family policy reflect the spirit and ideas embodied in T4 research. In summary, the translational model embraced by biomedicine is largely consistent with the family science worldview and existing practices.

The direction of translational science reflected in the biomedical perspective also offers meaningful insights for family science, albeit in competing ways. On the one hand, the relatively conservative approach requiring scrutiny of results from studies at multiple levels (e.g., basic

science and subsequent replication; efficacy studies and replication) before it is considered for wide potential application to people at the T3 stage has some wisdom. This type of checking and rechecking places a governor on pressures to prematurely move results from discovery studies to practice. Indeed, because there is no such thing as a perfect study—and the reality is that families are both complex and diverse—safeguards to protect against misuses of discovery science at any stage of research or phase of translation is valuable. However, on the other hand, problems emerge from pipeline models of translational science. One problem is that researchers are implicitly given leadership over translational science because its origins lie in basic research. Unfortunately, researchers are often two or more degrees of separation from their phenomenon of study, which leads one to question whether researchers are best equipped to conceive studies intended to resolve a real-world problem. For example, it is the rare family poverty researcher who experiences (or has experienced) poverty.

A second problem is the cost of lost resources because sufficient reality checks were not put in place by individuals who will ultimately use the research-based solution. Westfall et al. (2007) highlighted this problem by surfacing the important perspective of frontline health care personnel—practicing physicians and other healthcare delivery professionals—to translational science and the value of building practice-based research networks that reflect real-world delivery strategies for care. Likewise, research-based solutions for families that are not mindful of the constraints imposed by the usual delivery system for possible solutions, or cultural or contextual realities of the target population, will likely fail (e.g., see Middlemiss et al., 2017). So the typical progression of translational science is instructive because it suggests family scientists need to remain attentive to both the accumulation and the progression of a coherent body of

evidence from discovery studies, but the active voice and cumulative experience of practice scientists is needed throughout the accumulation and progression of that evidence.

A Model of Translational Family Science

The proposed model of translational family science (see Figure 2) follows from the fundamental motivation and foundational meaning of translational science as it has been advanced in biomedicine. The model also incorporates elements from models of translational science focused on public health (Ogilvie et al., 2009) and prevention science with a family focus (Spoth, 2008). An essential feature of the proposed model is explicit recognition that science underlies both discovery and practice. This feature is consistent with the thinking underlying biomedical models of translational science wherein the basic bench researcher and the clinician are both viewed as scientists given the basic definition of *science* (see Concepts and Principles of Translational Science section). Although practitioners' ways of systematically studying and experimenting with alternative strategies to achieve the best possible outcome for their clients is not research, it is nonetheless science. Therefore, the model contends that practitioners are just as much scientists as are researchers. Therefore, it purposefully identifies both the science of discovery and the science of practice to help bridge the research–practice divide.

The central focus of translational family science is family well-being, which is complex and multifaceted. In acknowledgment of family science's disciplinary heritage in family and consumer sciences, the model conceives of family well-being as competence in three primary areas: technical, relational, and emancipative (Baldwin, 1996). Technical competence, sometimes referred to as economic well-being (McKeown & Sweeney, 2001), refers to a family's ability to generate or acquire the material resources necessary for meeting the basic function of perpetuating society. Birthing, nurturing, and shaping young members of society

requires basic material resources like sufficient food for healthy physical development and maturation, as well as clothing and shelter to protect against external insults from natural (e.g., hurricane, flooding) or society-based (e.g., violent crime) sources. Relational competence refers to the presence of essential interpersonal and communication skills within a family, regardless of marital status or residence, as well as to age-appropriate relations between parents and their children. Finally, emancipative competence refers to a family members' ability, both individually and collectively, to recognize and reconfigure power imbalances within and external to the family. Emancipative competence assumes that every individual holds individual and social agency, and that a socially important element of nurturing the next generation of citizens is the ability to identify and eliminate any form of oppression. Henderson et al. (2017) provided a nice illustration of attentiveness to power in the conduct and implementation of family research. In summary, family well-being is conceptualized as the family's ability to generate or acquire its material needs to function, including the ability to create and re-create interpersonal relations within and outside the family that are attentive to and seek to eliminate systems of oppression.

The most proximal determinant of family well-being is the myriad of family processes identified through the array of models and theories of family functioning, formation and perpetuation of romantic relationships, and parenting and parent–child relations. In sharp contrast to existing models of translational science (Ogivile et al., 2009; Spoth, 2008; Sung et al., 2002) that emphasize the hegemonic advantage of research informing practice, the proposed model posits that research, or the science of discovery, originates from and is compelled by two basic sources. The first basic source is obvious: Science of discovery can and should originate from observations in the world about family well-being and its associated processes. The second basic source is typically overlooked; that is, the science of discovery can and should originate

from the science of practice, which is illustrated by the block arrows from the two ends of the "Science of Practice" continuum at the bottom of the figure to the "Science of Discovery" element in the center of Figure 2.

The rationale for contending the science of practice can and should serve as an origin or motivation for discovery science is based on philosophical, theoretical, and practical grounds. Consistent with the principle of organismic understanding discussed earlier, families can be understood only holistically; that is, families are more than the distinct actions, beliefs, and skills of its members and their interactions. Theoretically, families are often conceived as systems nested within broader social, cultural, and economic systems (e.g., family life course theory, ecological theory, family stress theory). This common conception requires discovery scientists to grapple with the fact that family processes and subsequent family well-being are influenced by practice scientists. Some of those practice scientists have regular direct contact with families (e.g., teachers, family life educators, clinicians), whereas others have indirect contact with families (e.g., legislators, marketers, entertainment providers). The influence that practice scientists have on families is illustrated by the line arrows from the two ends of the "Science of Practice" continuum at the bottom of Figure 2 to the "Family Processes" element in the figure. Practically, for discovery scientists motivated to resolve real-world problems affecting families or that occur from compromised family well-being, practice scientists often hold essential information needed to understand those problems and devise potential solutions (see Cox, 2017; Middlemiss, 2017).

The model recognizes the need for all approaches to the science of discovery. Like other models of translational science (see Mitchell et al., 2010; Ogilvie et al., 2009; Spoth, 2008), the diverse approaches to discovery are presumed to be equally important but incremental. Basic

laboratory work ranging from rodent models of harsh parenting (Lomanowska, Boivin, Hertzman, & Fleming, 2017) to human observational studies of parent–adolescent conflict resolution (Moed et al., 2015) are as important to translational family science as large population studies testing theoretically informed modifiable determinants of a desired family outcome or process. Likewise, intervention trials and replication studies are no more important than the preliminary work leading to their development. Synthesis is perhaps the only approach to the science of discovery that may have elevated priority because of its ability to quantify the extent to which results are replicated across studies, and replication is among the hallmark principals of discovery science. Importantly, the model contends feedback loops among the types of discovery science are necessary for purposeful and seamless communication to ensure promising discoveries make rapid progress through synthesis and subsequent implementation. Notably, these feedback loops are informed and enabled by practice scientists (Westfall et al., 2007).

Just as the science of discovery is multifaceted, translational family scientists need to acknowledge the complexity underlying the science of practice. First, following from the theoretical premise that families are, themselves, units of a larger social system, the model proposes that families are influenced and shaped by myriad external forces. The model attempts to capture some of this complexity by conceiving of practice science as a continuum defined by the regularity and directness of their contact with families. In some cases, practice scientists have regular and direct contact with family members (right side of the continuum in Figure 2). Sometimes regular and direct contact, such as that undertaken by marriage and family therapists or by family nurses, has the express purpose of influencing families through treatment activities. Other times regular and direct contact may be undertaken by parent educators or family life educators for purposes of enhancing family well-being by strengthening family processes (see

Darling, Cassidy, & Rehm, 2017). In other cases, the influence on family is largely indirect (left side of the continuum in Figure 2) and is illustrated by phenomenon such as family and economic policies, marketing forces such as those targeting basic human needs like food acquisition and meal alternatives, or popular culture's influence on thinking about sex and sexuality or what so-called normal families look like. Along the continuum between regular–direct and irregular–indirect contact with families are a variety of other influences on families that are either irregular and direct (e.g., family–youth interventions, school–community partnerships; see Cox et al., 2017; Sheridan & Wheeler, 2017) or regular but indirect (e.g., shaping legislative policy through family impact seminars; see Letiecq & Anderson, 2017).

The final component of the proposed model is the necessity of purposeful action to put the results of discovery science into the hands of practice scientists. This feature of the model is illustrated by the block arrows originating in discovery science directed toward both ends of the science-of-practice continuum. In the broader academy these arrows are frequently referred to as implementation and dissemination science. Whereas the focus of implementation science is the study of the methods to promote the adoption and integration of evidence-based activities, interventions, and policies into routine professional practice (National Library of Medicine, NLM, 2017b), dissemination science is the study of purposeful delivery of information and materials, which are based on evidence-based research, for purpose of action by a targeted constituent (NLM, 2017a). Two essential activities in dissemination and implementation science are the transfer and the transformation of knowledge and practice from discovery science to practice science (see Middlemiss et al., 2017). The model purposefully illustrates implementation and dissemination with two arrows to the left and right ends of the science-of-practice continuum to remain vigilant to the reality that the form, content, and delivery mechanism of these feedback

loops are contingent on both the substance of the knowledge or topic of communication and the intended audience.

An Agenda for Moving Forward

If the goal of this article has been achieved, the reader can now clearly see that translational science is not simply a trendy concept invented to repackage and upscale applied research. Instead, it was intended by Zerhouni (2003), the former director of the NIH, to initiate a paradigm shift in how science is conceived. The motivation underlying this paradigm shift was the "valley of death" attributed to the approximately 17-year gap between discovery of a potential life-enhancing agent and its implementation in everyday practice (Morris et al., 2011). Although family scientists have engaged in elements of translational science throughout the development and growth of the discipline (see Darling et al., 2017; Hamon & Smith, 2017), the discipline has suffered from the fissure between science and practice, as well as the perpetuation of disciplinary ethnocentrism. Nearly 20 years of thinking and formalizing has gone into the development of translational science as an integrated activity of both discovery and practice science designed to build bridges between the types of science acting in the field. We contend that complementing the field's joint commitment to discovery and practice with the established and emerging understanding of translational science can be useful for branding family science as it moves forward in broader academic, practice or care delivery, and policy arenas. The remainder of this article articulates a high-priority agenda of activities for realizing this potential.

The High-Priority Agenda

1. Build purposeful bridges between the sciences of practice and discovery. Following Westfall et al.'s (2007) contention, clinician researchers in marriage and family therapy at Brigham Young University have launched a practice-based research network to enable more seamless

T3 research. This type of initiative provides one concrete example of a bridge between the sciences of discovery and practice, but more bridges are needed.

a. Family science could leverage its linkages to family-serving organizations and agencies, such as those hosting and hiring Certified Family Life Educators, to build networks of teams that comprise both discovery and practice scientists to move toward the creation of data-collection models similar to those in practice-based research networks.

b. Rather than organizing the NCFR's annual conference content around the activities of specific sections that are largely content driven, perhaps sessions and plenaries could be organized around stages of research or phases of translation.

c. Perhaps the NCFR could create and task working subcommittees of the organization to generate fact sheets similar to those developed by Cooperative Extension. One set of fact sheets could review results of recent (e.g., past five years) discovery science in different domains of family science (e.g., parenting education, family life education, relationship education) with the goal of translating those findings into key talking points for awareness or action targeting practice scientists in that same domain of family science. Another set of fact sheets could summarize pressing problems or emerging issues that are vexing to practice scientists and translate those into corresponding research questions for discovery scientists.

2. Develop thresholds or criteria for determining when a finding is sufficiently replicated or firmly established enough to move toward some type of practice. Epistemology—or "How do we know what we know?"—is at the heart of this agenda item, and because it is fundamentally a philosophy-of-science issue, it is unlikely to identify universally accepted

answers. Nevertheless, discovery scientists and practice scientists need guidelines to avoid premature movement toward intervention while being attentive to the need to quickly identify and move promising discoveries toward practice (Ostergren, Hammer, Dingel, Koenig, & McCormick, 2014). In drug and device research and development this issue is captured by asking, "What's the best way to make go, no-go decisions?" NCFR should partner with peer professional organizations like the American Association of Marriage and Family Therapy, the American Association for Family and Consumer Science, and perhaps divisions of the American Psychological Association, the Population Association of America, and the American Sociological Association to create these thresholds.

a. One part of this task is developing rubrics or agreed-upon systems for characterizing the scientific merits of different types of discovery science. A variety of models and systems have been developed (e.g., quality of reporting of meta-analysis, Moher et al., 1999; meta-analysis of observational studies in epidemiology, Stroup et al., 2000; and transparent reporting of evaluations with nonrandomized designs, Vlahov, 2004), but none accommodates the diversity and array of discovery-based family science.
b. Another part of the task is a purposeful (and challenging) analysis of the costs and benefits of moving too quickly and too slowly to practice. For some topics (e.g., the dangers of excessive television viewing) there may be little risk in moving to intervention without mountains of replicated data. That said, the fact that a premature intervention may not cause harm does not negate the reality that such interventions siphon limited financial and human resources, thereby detracting from activities that could have greater impact. Other topics, such as the consequences of divorce (and the corollary questions of "Should divorce ever be advocated?" or "Should obtaining a

divorce be made more difficult?"), are complex because they have short- and long-term consequences at the individual, interpersonal, and societal levels. If discovery science runs its full arsenal of alternative research approaches before releasing definitive findings, is the cost of lives affected during that period of discovery worth the assurances gained from waiting for those definitive findings? Results from these types of analyses, and results that involve experience, data, and ethical reasoning, are needed to make informed decisions about the best strategy for moving from discovery to practice.

3. Family scientists need to learn from previous experience and avoid pitfalls encountered by other disciplines striving to bridge discovery and practice science. The Boulder model of clinical psychology, which emerged in part from the fractioning and subsequent reintegration of applied (i.e., clinical) and academic (i.e., research) psychologists (Frank, 1984), provides one example. The essence of the Boulder model was the production of scientist–practitioners, or individuals who are simultaneously committed to both the science of discovery and the science of practice. The overarching utility of the Boulder model remains open to debate, with some contending it is pedagogically unsound (Frank, 1984) and others contending it is fundamental to the discipline's future success (Belar, 2000); nevertheless, it is instructive because it speaks to fundamental activities needed to build bridges between scientists of discovery and practice.

    a. Moving forward requires locating common ideological ground. A series of organizational realignments (including development and implementation of the Boulder model) required the membership of the American Psychological Association to willingly identify primarily as a psychologist and secondarily as either an

"academic psychologist" or "clinical psychologist" (Frank, 1984). In like fashion, NCFR members need to identify themselves primarily as family scientists (or another identified label) and secondarily in terms of particular vocation (e.g., family life educator, researcher, or therapist) or specialty area (e.g., family demography, family policy).

b. Moving forward requires respecting divergent contributions necessary for advancing the field. Advancement of the Boulder model helped the American Psychological Association recognize that its applied subdisciplines (e.g., clinical and counseling psychology) were both a source for intellectual inspiration and a practical vehicle for achieving its mission, which is to "advance the creation, communication and application of psychological knowledge to benefit society and improve people's lives" (American Psychological Association, 2017). Although less succinct, NCFR's (2017) mission to "provide an educational forum for family researchers, educators, and practitioners to share in the development and dissemination of knowledge about families and family relationships, establish professional standards, and work to promote family well-being" is similar and draws attention to the coequal needs of practice and discovery scientists.

4. Family scientists need to develop curriculum, particularly in graduate education but also undergraduate education on the doctrines and principles of translational family science.

   a. Although the doctrine of evidence-based practice will undoubtedly be easy to embrace, it will take some hand-wringing and deliberate discussion to determine what constitutes evidence. As Gilgun (2005) pointed out, the exclusive focus on empirical results overlooks the knowledge and values of the end users of our collective research

as well as the professional expertise and experience of trained practice scientists. Curriculum is needed to promote critical thinking for determining what evidence counts under which circumstances. This step is connected with Point 2a.

b. Training in true multidisciplinary and transdisciplinary research methods is needed. As brief example will illustrate the point that most readers will likely bypass because family science is inherently interdisciplinary. During an interaction nearly 15 years ago, the first author of this article asked an economist who had been trained at the Massachusetts Institute of Technology and was tenured at Harvard University, to calculate a Cronbach's alpha on a set of items, and the response back was, "What's that?" Subsequent discussion made it clear that both researchers were committed to sound measurement of key constructs, but one prioritized internal consistency, whereas the other prioritized threats from endogeneity bias. This example illustrates that every discipline's methods are driven by core principles that are codified in conventions that are sometimes idiosyncratic. In like fashion, whereas clinicians in some fields are primarily focused on the sensitivity and specificity of measures, researchers in the same basic field are primarily interested in measurement qualities pertaining to validity and reliability. Both the practice scientist and the discovery scientist are interested in good measurements, but they differ in the criteria used to evaluate good. Therefore, an essential requirement of effective multidisciplinary training requires training in, and discernment of, principles underlying science (e.g., good study design comes down to appropriate sampling of observations and effective measurement of key concepts) from the conventions used to manifest those principles (e.g., whether Cronbach's alpha exceeds .70; whether the sample was recruited

purposefully or obtained through random selection). Each of these points emphasizes that commitment to multidisciplinary utility requires scientists of discovery and practice to be trained in the principles of sciences, and those principles need to be clearly differentiated from conventions used in different branches of science because confusing conventions and principles will likely impede multidisciplinary efforts.

c. Curriculum is needed that embraces rather than laments scientific dualism, or the idea that the sciences of practice and discovery must be interdependent. Unlike the Boulder model, the purpose of these curricula is not to create a practitioner who can conduct peer-reviewed research, or a researcher who is capable of providing direct care. Instead, the purpose of a curriculum that embraces scientific dualism is to foster an awareness of the methods used in both discovery science and practice science as well as the constraints and priorities of both branches of science. It is our view that awareness is a necessary first step toward appreciating the valuable contributions both sides of science can bring to bear to strengthen and support families.

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Table 1

Principles of Translational Science that Collectively Shape the Doctrine of Evidence-based Practice

Principle	Description
Science produces real knowledge	Observable and presumably replicable results from scientific discovery are valued over personal or professional experience, opinion, and beliefs.
Mechanistic understanding	The best way to understand, and therefore modify or change a complex system is to (a) break the complex system down into its simplest elements, (b) study each of the simple elements, and (c) study the interrelations among simple elements.
Scientific dualism	All scientific inquiry, regardless of discipline or methodological approach, occurs in two forms: basic research focused on discovery and clinical research focused on the application of discovery.
Multidisciplinary utility	Scientists from different disciplines operating in both the science of discovery and the science of practice are essential for developing solutions that have real-world impact.
Corollary	
Bridge building is essential	Scientific dualism and multidisciplinary utility require building bridges or purposeful connections among disciplines and between the science of discovery and the science of practice.

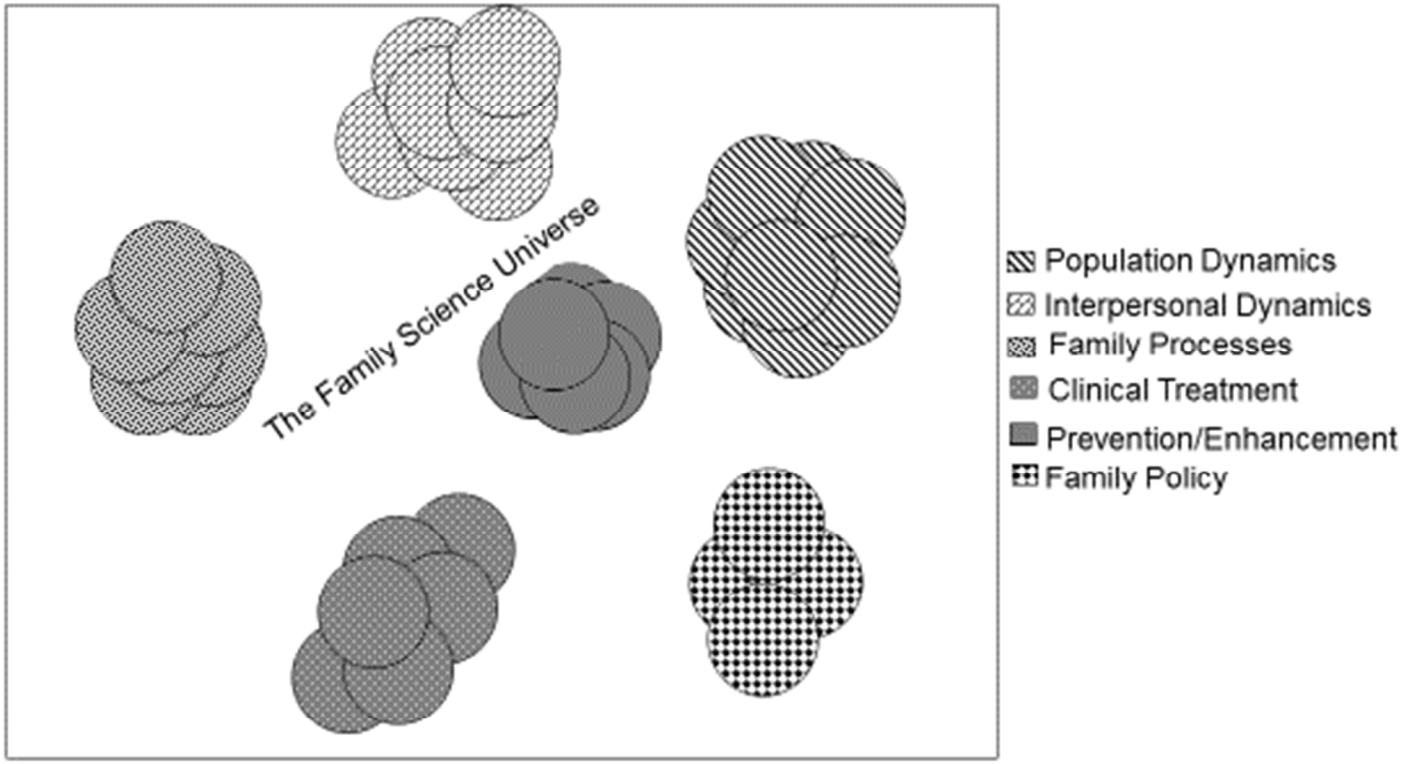

Figure 1. The motivation for translating family science: Clustering of disciplinary specialty and the resulting gaps in covering the "family science" university.

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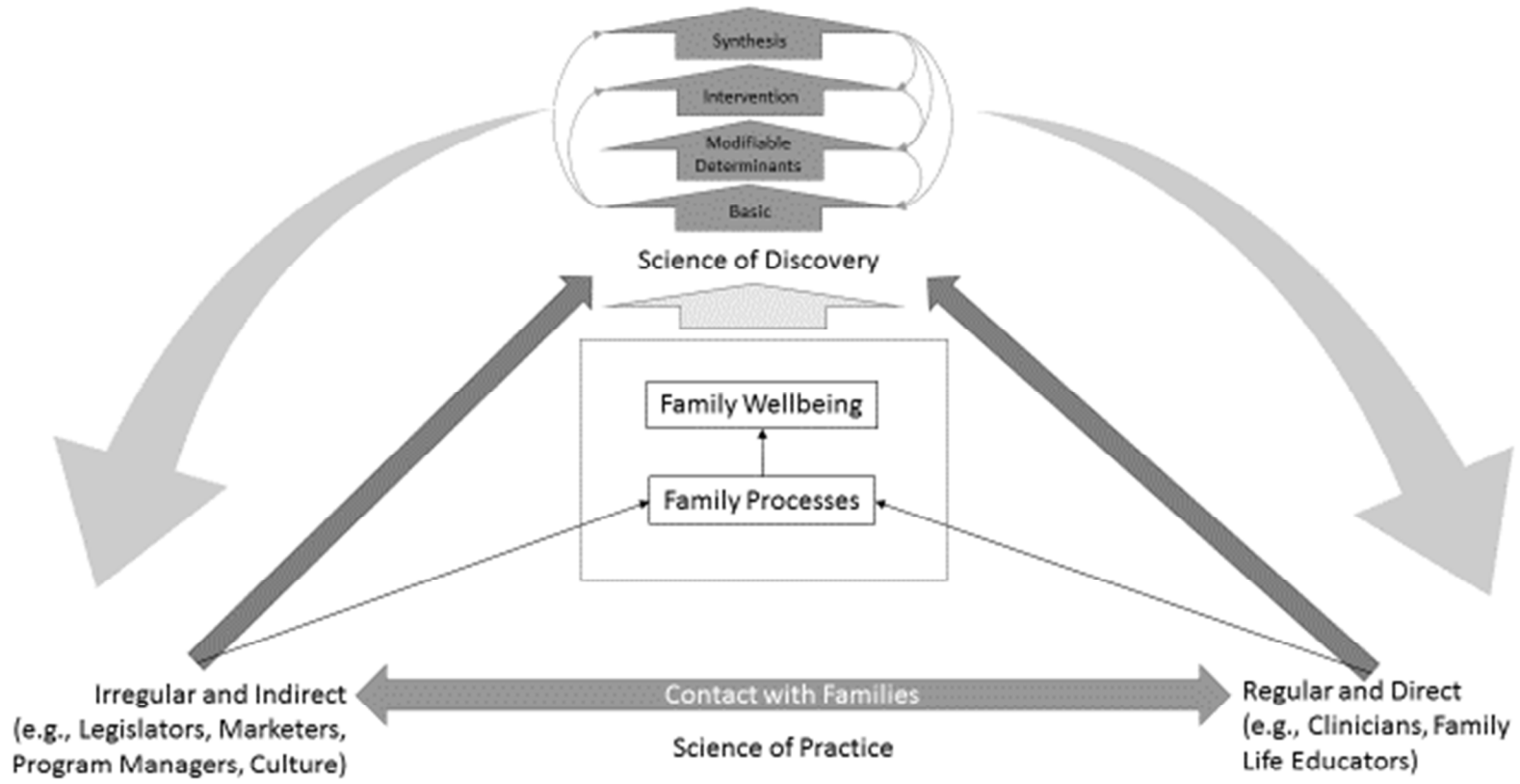

Figure 2. Conceptualization of translational family science.

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