A thematic analysis of theoretical models for translational science in nursing: Mapping the field

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The quantity and diversity of conceptual models in translational science may complicate rather than advance the use of theory. This paper offers a comparative thematic analysis of the models available to inform knowledge development, transfer, and utilization. Literature searches identified 47 models for knowledge translation. Four thematic areas emerged: (1) evidence-based practice and knowledge transformation processes, (2) strategic change to promote adoption of new knowledge, (3) knowledge exchange and synthesis for application and inquiry, and (4) designing and interpreting dissemination research. This analysis distinguishes the contributions made by leaders and researchers at each phase in the process of discovery, development, and service delivery. It also informs the selection of models to guide activities in knowledge translation. A flexible theoretical stance is essential to simultaneously develop new knowledge and accelerate the translation of that knowledge into practice behaviors and programs of care that support optimal patient outcomes.

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INTRODUCTION AND BACKGROUND

There is a burgeoning array of models, definitions, and nomenclature in the field of evidence-based practice (EBP) and translational science. Limited awareness of the range of models and their respective utilities constrains the dissemination and adoption of research findings. Moreover, a lack of conceptual clarity makes it difficult to interpret the results of dissemination research and to synthesize the outcomes of knowledge transfer and utilization activities.[1] Several authors have[2-8] recently urged attention to conceptual development in the field of knowledge translation.

Our purpose is to contribute to such conceptual development by critically analyzing the available models for EBP and translational science. Thematic analysis was applied to characterize and compare the available conceptual approaches to EBP and translational science. In so doing, we demonstrate the span of available theoretical models for translational science, distinguish the various conceptual approaches, and illustrate how model selection differentially shapes the aims, methods, and outcomes evaluation of a specific knowledge translation initiative. This thematic analysis distills the large number of translational science models into a schema that can be used by clinicians, policymakers, and researchers to guide rational selection of conceptual models for EBP initiatives, organizational efforts to accelerate the adoption of best practices, and the design and interpretation of dissemination and implementation research. An understanding of the full range of conceptual models across the translational science continuum also contributes to mapping the state of knowledge development in a particular substantive content area, thereby highlighting gaps in our knowledge base and framing possible strategies to address those gaps. Such an approach helps to ensure that our scientific agenda remains focused on systematically building a knowledge base across the translational science continuum that is highly relevant to nursing practice and programs of care.

METHODS

Articles discussing theoretical models for EBP, knowledge uptake and adoption, and translational science were systematically gathered through electronic searches of PubMed, CINAHL, PsychInfo, and Web of Science. Using the key words *translation*, *translational science*, *EBP*, *research utilization*, *knowledge translation*, *knowledge transfer*, *dissemination*, *implementation*, *adoption of innovation*, *theory*, *framework*, and *conceptual model*, 830 articles were obtained. An additional 244 articles were identified for review by hand-searching the reference lists and by examining citations identified in the electronic databases as related references. Search strategies were repeated 5 times during the project as the literature was updated, and results are current to October 2009.

Abstracts of the publications identified through these searches were screened by the first author, a doctorally prepared nurse scientist, to reduce the search results to a core collection for further analysis. Papers selected for further analysis were English language reports, and had as their primary objective: (1) to describe a theoretical model for knowledge translation or translational science, or (2) to describe a minor or major modification of a previously identified model. Retained publications represented nonduplicate descriptions of theoretical models for EBP; research utilization (RU); knowledge dissemination, translation, or implementation; dissemination research; or translational science. Papers addressing organizational behavior, change theory, or systems theory more generally, rather than knowledge translation explicitly, were excluded.

The nonduplicate publications resulting from the search strategies described yielded 47 distinct conceptual models addressing EBP and translational science. Two of the authors, both doctorally prepared, independently analyzed the attributes of these 47 conceptual models, extracting from each the purposes; major constructs; tenets and assumptions; logical consistency; generalizability; parsimony, and testability; and utility for translational science. From this critical appraisal, four distinct thematic areas emerged under which the conceptual models could be arranged. Definitions for each of the thematic areas were then developed. The definitions were designed to achieve mutually exclusive yet not exhaustive categories. Ultimately, the goal was to develop an organizing schema that would assist clinicians and researchers, wherever they were engaged along the translational science continuum, to make a coherent match between the aims of a specific initiative and the theoretical model chosen to guide that work.

The classification of models into the thematic categories was independently verified by a third doctorally prepared investigator. Classification discrepancies were discussed among the team members and definitions for each of the 4 thematic areas were further refined until consensus was achieved. This analysis supported the existence of four themes under which the conceptual models could be organized.

RESULTS AND ANALYSIS

Thematic analysis placed the 47 conceptual models into 4 thematic areas representing: (1) EBP, RU, and knowledge transformation processes; (2) strategic and organizational change theory to promote uptake and adoption of new knowledge; (3) knowledge exchange and synthesis for application and inquiry; and (4) designing and interpreting dissemination research. The critical attributes of the models within each thematic area and the distribution of the models across the four thematic areas are summarized in Table 1.

Thematic Area 1: EBP, RU, and Knowledge Transformation Processes

Conceptual models under this thematic area[9-16] direct a systematic approach to synthesizing knowledge to improve patient outcomes and the quality of care. Several of the models within this thematic area specify a series of processes designed to: (1) Identify a question/topic/problem in health care; (2) retrieve evidence that is relevant to that focus; (3) critically appraise the level and strength of the evidence; and (4) synthesize and apply the evidence to improve clinical outcomes. Other models emphasize the process by which knowledge is transformed from primary research findings into a format (eg, clinical practice guidelines, technology assessment, standards of care) that has utility for decision making in clinical practice. Some of the models do address outcomes evaluation; however, the measurement of outcomes is designed to determine whether a practice change produced the expected clinical outcome or to compare actual with ideal practice (thereby identifying unacceptable practice variation) rather than to understand the mechanism by which the outcome was achieved or to draw conclusions about what interventions are effective in a specific population. Models in this thematic area diverge relative to what constitutes evidence (empirical evidence vs guidelines); what action should be undertaken if there is inadequate evidence; and the extent to which patient/family preferences and practitioner expertise/craft knowledge are prominent.

Thematic Area 2: Strategic/Organizational Change Theory to Promote Uptake and Adoption of New Knowledge

Models within thematic area 2[17-35] describe the mechanisms by which individuals, small groups, and organizational contexts affect diffusion, uptake, and adoption of new knowledge and innovation. Many of these models propose that specific interventions—such as facilitation, use of opinion leaders, and real-time

feedback about individual or aggregated patient outcomes—positively affect these mechanisms. Feedback to practitioners about their variation from best practice is proposed to promote practitioners' adoption of practices that are based on best evidence. Thus, within these models, feedback regarding both patient and practitioner outcomes is seen as a change strategy. Models within this second thematic area address constructs and stakeholders from the perspective of the individual, team/unit, institution, and the health care system. An important distinction to note is that the lexicon for this thematic area tends to be directional from researchers to adopters/users, which may inadvertently imply that adopters possess limited knowledge of effective practice, although some models begin to suggest an interaction between researcher and end-user of knowledge.

Thematic Area 3: Knowledge Exchange and Synthesis for Application and Inquiry

Models within the thematic area of knowledge exchange and synthesis for application and inquiry[36-45] propose that a formalized process of regular and ongoing interactions among practitioners, researchers, policymakers, and consumers accelerates the application of new discoveries in clinical care. They suggest that such interactions also increase the likelihood that researchers will focus on problems of importance to clinicians. Thus, these models simultaneously address both the generation of new knowledge (inquiry) and efforts to make that knowledge available to clinicians, policymakers, and consumers/community in a format that promotes immediate application. In contrast to thematic areas 1 and 2 in which the flow of information tends to be directional from researchers to practitioners, models under thematic area 3 emphasize engaging researchers, practitioners, public policymakers, consumers, and communities in bidirectional collaboration across the translational continuum. This collaboration supports the sharing of expertise and knowledge exchange to strengthen decision making and action for all involved parties. Creating and sustaining a climate of mutuality and consensus is an essential element of models within this theme.

Thematic Area 4: Designing and Interpreting Dissemination Research

Models in thematic area 4[7,46-69] identify aspects that structure the design and interpretation of dissemination research. Dissemination research refers to studies designed to evaluate the effectiveness of an intervention in a population and/or to evaluate a process of transferring the knowledge, skill, and systems support needed to deliver an intervention to a target audience.[57,70] That target audience could encompass practitioners, health care consumers, communities, and public policymakers. Dissemination research develops generalizable empirical evidence to determine the effectiveness of an intervention with widespread application. This approach is distinct from smaller scale studies designed to establish the efficacy of a proposed intervention. As a methodology, dissemination research also determines the best implementation methods to help target audiences receive, accept, and use information and interventions.[68,71,72] Within this thematic area, conceptual models emphasize the measurement of immediate and longer-term patient, process, and system outcomes to evaluate intervention effectiveness with widespread application. Dissemination research designs aim to identify the variables that explain (predict, interact, mediate, or moderate) a target audience's awareness, acceptance, and use of knowledge and innovation. Models in thematic area 4 also underscore the importance of addressing intervention fidelity, tailoring, and feasibility (eg, cost, acceptability to patients, adherence, satisfaction, etc) when studying wide-scale implementation of an intervention.

SUMMARY OBSERVATIONS

Diversity in the origins, development, and reach of conceptual models is evident. Within the four thematic areas, the models and their underlying concepts are specified at varying levels of precision, abstraction, complexity, and scope. Some models are linear and directional, whereas others demonstrate a nonlinear, multidirectional, or cyclical pattern of divergent and convergent activities. Although the EBP and RU models were found predominantly in the nursing literature, models within the other three thematic areas crossed several disciplines including health services research, behavioral science, and organizational psychology. We also observed differences among the models relative to whether they were developed empirically and inductively,[20,34,44,50] deductively and based on theoretical propositions,[17,25,27,36,55] or whether a combination of inductive and deductive processes were used.[32,37,48] Although there were notable exceptions,[21,41,73] few of the models have been tested explicitly.

Fit of the Four Thematic Areas with the Overarching Translational Science Continuum

The four thematic areas can be arranged within the overarching translational science continuum.[74] As depicted in Figure 1, the translational science continuum provides an overview of the process by which discoveries are generated, developed, and implemented into effective and widely available clinical applications. A number of representations of the translational research process have been proposed.[70,75-80] Although there is variation among these representations relative to terminology and the number of identified phases, all describe a recursive sequence of activities from basic science discoveries through adoption in routine clinical practice.[81] Factors that impede the transfer of research to application may be historic, political, economic, scientific, cultural, or organizational.[33,67,82,83]

Table 1. Models for EBP and Translational Science

Thematic Area	Description	Models
1. EBP, research utilization, and knowledge transformation processes	*Purpose:* Direct a systematic approach to synthesizing knowledge and transforming research findings to improve patient outcomes and the quality of care. *Emphasis/Scope:* Models address both individual practitioners and health care organizations, and focus on increasing the meaningfulness and utility of research findings in clinical decision making.	• Conduct and Utilization of Research in Nursing (CURN)[9] • John's Hopkins Nursing Evidence-Based Practice Model and Guidelines[10] • ACE Star Model of Knowledge Transformation[11] • Advancing Research and Clinical Practice through Close Collaboration (ARCC) Model of Evidence-Based Practice in Nursing and Healthcare[12] • Iowa Model of Evidence-Based Practice[13] • Stetler Model of Research Utilization[14] • Rosswurm & Larabee "Research Utilization Model"[15] • Caledonian Practice Development Model[16]
2. Strategic/Organizational change theory to promote uptake and adoption of new knowledge	*Purpose:* Describe the mechanisms by which individual, small group, and organizational contexts affect diffusion, uptake, and adoption of new knowledge and innovation. *Emphasis/Scope:* Models propose that interventions, outcomes evaluations, and feedback are important mechanisms. Lexicon tends to be directional from researchers to adopters/users, although some models suggest an interaction.	• Determinants of Innovation within Health Care Organizations[20] • UCLA/RAND Framework[35] • Promoting Action on Research Implementation in Health Services (PARiHS)[18,19,21-23] • Vratny & Shriver Model for Evidence Based Practice[24] • Pettigrew & Whipp Model of Strategic Change[33] • Outcomes-Focused Knowledge Translation[25] • Joint Venture Model of Knowledge Utilization[34] • Determinants of Effective Implementation of Complex Innovations in Organizations[26] • Ottawa Model of Research Use[27,28] • Diffusion of Innovation Model[29] • Stages of Research Utilization Model[30,31] • User-Context Framework for Knowledge Translation[32] • Framework for Research Dissemination and Utilization[17]
3. Knowledge exchange and synthesis for application and inquiry	*Purpose:* Formalize the process of ongoing interactions among practitioners, researchers, policymakers, and consumers to facilitate both the generation and application of new knowledge. *Emphasis/Scope:* Models emphasize engaging all parties in bidirectional collaboration across the translation continuum.	• Collaborative Model for Knowledge Translation Between Research and Practice Settings[36] • Framework for Translating Evidence into Action[37] • Knowledge Transfer and Exchange[38] • Canadian Institutes of Health Research Knowledge Translation within the Research Cycle Model or Knowledge Action Model[39-41] • Community Based Participatory Research (CBPR)[42] • Interactive Systems Framework for Dissemination and Implementation[43] • Linking Systems Framework[44] • Locally Based Research Transfer Model[45]

Table 1 Continued

Thematic Area	Description	Models
4. Designing and interpreting dissemination research	*Purpose:* Identify aspects that structure the design and interpretation of dissemination research. *Emphasis/Scope:* Models emphasize the effectiveness of interventions with widespread application and the methods to make target audiences aware of, receive, accept, and use information/ interventions.	• Sticky Knowledge Framework[48] • Explaining Behavior Change in Evidence-Based Practice[49] • Conceptual Model for Considering the Determinants of Diffusion, Dissemination, and Implementation[50] • US Department of Veterans Affairs (VA) Quality Enhancement Research Initiative (QUERI)[47,51-53,68] • Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance (RE-AIM)[54] • Replicating Effective Programs Framework[55] • Practical, Robust Implementation and Sustainability Model (PRISM)[69] • Improved Clinical Effectiveness through Behavioural Research Group (ICEBERG) Model[56,60] • Dissemination Research Design[57-59] • Technology Transfer Model[46] • Conceptualizing Dissemination Research and Activity: Canadian Heart Health Initiative[61] • Framework for Transferring Knowledge into Action[7] • Translational Framework for Public Health Research[62] • Framework for Health Promotion Innovation Development[65] • Translational Research Framework to Address Health Disparities[63] • Consolidated Framework for Implementation Research[64] • Utilization Focused Surveillance Framework[67] • Tehran University of Medical Sciences (TUMS) Knowledge Translation Model[66]

A wide variety of activities are encompassed by the translational science continuum including comparative effectiveness research, implementation research, dissemination, diffusion, knowledge transfer, uptake, RU, adoption, and sustainability. The lack of standardized terminology reflects the fact that translational science is a nascent and multidimensional field incorporating many disciplines and organizations, both within the health sciences, and in the fields of marketing, communication, education, and management.[84-86] Table 2 provides definitions for selected key terms.

Familiarity with models across the translational science continuum is a fundamental requirement if we are to take an encompassing view of a process that spans scientific discovery, the development of those discoveries into novel interventions, and the implementation of those innovations by practitioners, policymakers, and communities. Our thematic framework for organizing the diverse range of conceptual approaches to knowledge development and translation assists researchers, practitioners, and change agents when selecting a model to guide a specific initiative in translational science. For example, when planning activities to promote knowledge uptake, depending on the purposes and the stakeholders involved, an individual or organization might select from among EBP, RU, or strategic change models. On the other hand, if partnering with researchers, policymakers, or communities, one of the models addressing knowledge exchange and synthesis for application and inquiry might be most useful.

The thematic areas can also be applied to structure empiric findings within a particular area, thereby highlighting gaps that exist in that knowledge base. In this way, the thematic areas facilitate identification of challenges across the knowledge translation continuum,

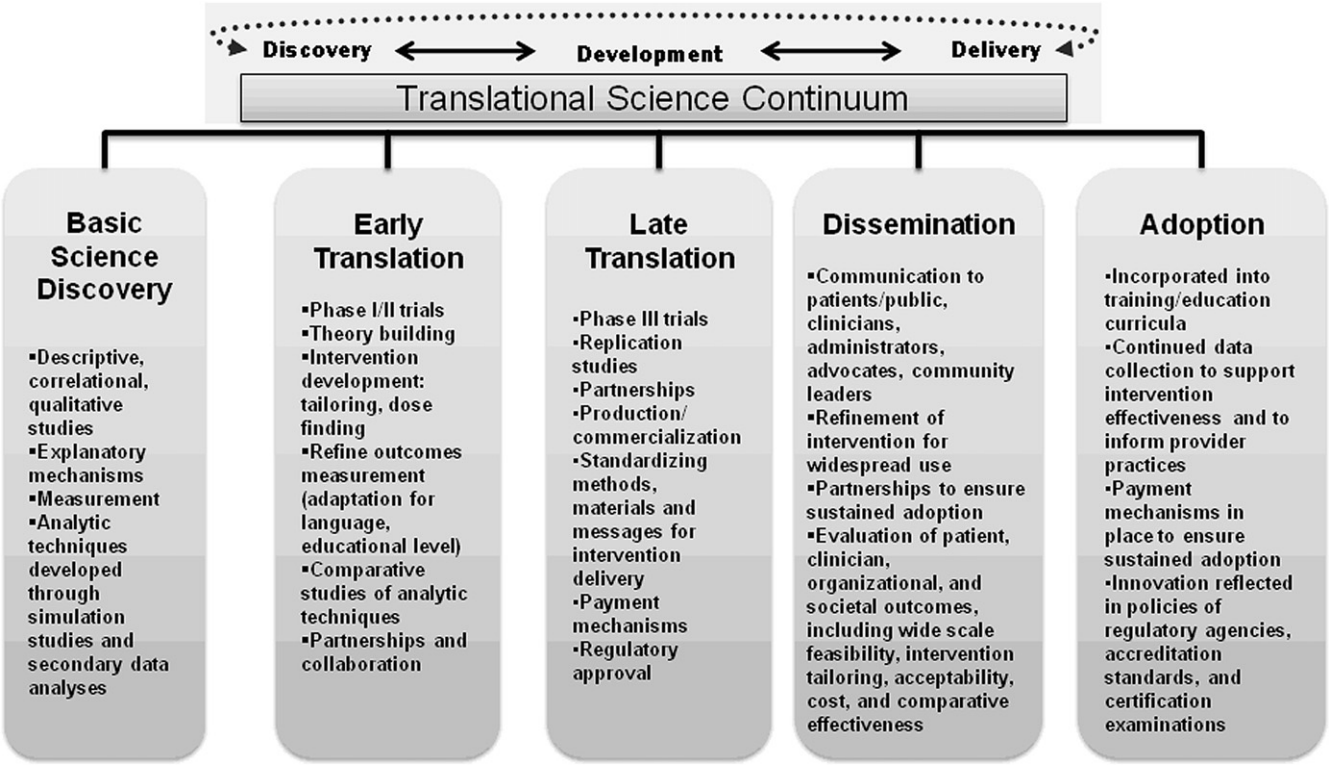

Figure 1. Activities to accelerate discovery, development, and delivery across the translational research continuum. Source: Adapted with permission from President's Cancer Panel 2004-2005 Annual Report—Translating Research into Cancer Care: Delivering on the Promise (p.ii) by U.S. Department of Health and Human Services, National Institutes of Health, and National Cancer Institute, 2005, Bethesda, MD: Author. Copyright 2005 by U.S. Department of Health and Human Services, and used for Berger, A. & Mitchell, S. (2009). Accelerating the research translation continuum (p. 315-349). In J.M Phillips and CR King (Eds). Advancing Oncology Nursing Science. Pittsburgh: Oncology Nursing Press. Used with permission.

which requires greater scientific and programmatic attention. Knowledge of the different approaches encompassed by each thematic area also contributes to framing the scope of an issue and to developing specific hypotheses that can be tested empirically.

The 4 thematic areas also distinguish the contributions made by researchers and by end users (clinicians, policymakers, communities, or patients) at each phase along the translational science continuum from discovery through development, dissemination, and implementation in practice. Each of the thematic areas also differentially focuses on design, implementation, and evaluation considerations relative to scientific discovery, early and late translation, and dissemination and adoption of new approaches. Using the issue of tobacco cessation, we demonstrate this capacity of the thematic areas to inform problem framing, and we illustrate how each thematic area is associated with a distinct emphasis and different action strategies.

Application of the Transtheoretical Approach to Knowledge Development and Translation: Tobacco Cessation as an Example

Tobacco use, in all its forms, including smokeless tobacco, is a significant health behavior concern affecting children, adolescents, and adults and is associated with substantial morbidity and mortality. However, despite these serious health consequences and a substantial body of scientific knowledge concerning effective strategies for prevention and cessation of tobacco use across settings (schools, communities, clinics, and hospitals), the prevalence of tobacco use worldwide is increasing. Literature in the field of tobacco prevention and cessation illustrates how theoretical approaches within each thematic area differentially frame the strategies to develop and implement knowledge to achieve tobacco abstinence.

Relative to EBP, RU, and knowledge transformation processes (thematic area 1), activities in the field of tobacco cessation have included critically appraising and synthesizing the research evidence concerning effective strategies for tobacco cessation,[87,88] developing and distributing evidence-based guidelines for clinical intervention,[89-91] devising an interdisciplinary tobacco cessation protocol for inpatients,[92] refining the measurement of clinical outcomes of smoking cessation programs,[93] and developing curricula for health professional education.[94,95] Such knowledge synthesis efforts are fundamental in bridging from late translation to dissemination and adoption.[63] Specific knowledge synthesis formats can be subsequently tested, compared,

Table 2. Terminology for Dissemination and Implementation Research in the Health Sciences

Knowledge translation	The exchange, synthesis, and ethically sound application of knowledge within a complex system of interactions among researchers and users to improve health, provide more effective health services and products, and strengthen the health care system[1,39,151]
Evidence-based practice	An approach to planning and delivering care that integrates best available research evidence with practitioner expertise and the client/population's needs, characteristics, values, and preferences[136]
Research utilization	Process by which empirical findings from one or more studies are transformed into nursing interventions and/or into tools that support clinical decision-making such as guidelines, protocols, or algorithms[152]
Knowledge transfer	Imparting research knowledge from producers to end users[153]
Knowledge utilization	Research, scholarly, and programmatic interventions activities aimed at increasing the use of knowledge to solve human problems[154]
Knowledge integration	The effective incorporation of knowledge into the decisions, practices, and policies of organizations and systems[155]
Dissemination research	Studies designed to evaluate the effectiveness of an intervention in a population and/or to evaluate a process of transferring to a target audience the knowledge, skill, and systems support needed to deliver an intervention. The concern is with both internal and external validity and with the intervention effectiveness in a large and diverse population. Other emphases include treatment fidelity, feasibility, cost, adherence, patient acceptability and satisfaction, and treatment tailoring[44,57,84,144,156]
Implementation science	Empirical study of the methods, strategies, and variables to influence adoption of evidence-based health care practices by individuals and organizations to improve clinical and operational decision making[84,157]
Translational research	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[79,158]
Dissemination	Passive and spontaneous (diffusion) and active and planned efforts to persuade target groups to adopt an innovation[29,50]
Uptake	Acquisition of research knowledge and its utilization in action and decision making[154]
Adoption	Adoption is defined as having occurred when (1) individuals and systems possess and retain the necessary capacity for ongoing use of an innovation, and (2) when that innovation has become routine, and remains routine, until it reaches obsolescence[50]

and refined through dissemination research. The dissemination of practice guidelines and narrative reviews also contributes more generally to building system capacity for the delivery of smoking cessation interventions.[96]

Approaches to promote uptake of research findings through specific interventions such as expert facilitation,[97] audit and feedback,[98] decision-support delivered at the point of-care,[99-101] and the use of opinion leaders and policy changes[102-104] (thematic area 2) have demonstrated effectiveness in increasing the adoption of tobacco cessation interventions into routine clinical practice. Such approaches focus on the processes of strategic and organizational change and give limited attention to measuring intervention effectiveness (eg, initial and long-term smoking abstinence rates).

Models that emphasize knowledge exchange and synthesis for application and inquiry (thematic area 3) formalize a bidirectional collaboration process among researchers, clinicians, policymakers, and consumers/communities. As an outcome of this collaboration, technology and expertise relative to tobacco cessation are exchanged to benefit decision making and action for all involved stakeholders. As an example of this, a recent report describes a community of practice that developed around web-assisted tobacco interventions.[105] Engaging a variety of disciplines and representing clinicians, researchers, consumers, and policymakers, collaboration in the community of practice produced a recommended minimum dataset of items for use in web-assisted tobacco interventions, guidelines for developing web-assisted tobacco interventions, and a strategy to engage consumers. These outcomes simultaneously enriched the delivery of web-assisted tobacco intervention, improved linkages among participants in the network,

and strengthened the research infrastructure. McDonald and Viehbeck have also described a collaborative model of research translation for tobacco cessation known as The North American Quitline Consortium (http://www.naquitline.org).[106] Comprised of researchers and program providers from Canada and the United States, the consortium collectively focuses on developing and sharing evidence to improve telephone-based counseling for tobacco cessation. Strategic goals and priorities for the consortium are mutually negotiated through web-based seminars, teleconferences, and face-to-face meetings. Topics for discussion include, but are not limited to, potential funding opportunities, clinical and research outcomes evaluation, and identification of gaps in the current evidence base for tobacco cessation intervention comparative effectiveness.[106]

Exemplifying the application of models emphasizing elements in the design and interpretation of dissemination research (thematic area 4) are three recent studies that examined the effectiveness of delivering smoking cessation interventions in inpatient settings[107,108] and primary care practices[109] within single-payer networks. Across the studies, a variety of approaches were deployed to promote clinicians' routine delivery of smoking cessation interventions, including training of providers in the delivery of bedside smoking cessation counseling; electronic medical record innovations to facilitate prescription of pharmacotherapy for cessation; computerized referral of motivated inpatients for telephone counseling; and practice facilitation, expert feedback, and monitoring. Intervention effectiveness was assessed by initial and prolonged smoking abstinence rates, likelihood of receiving a prescription for pharmacotherapy for smoking cessation (the "reach" of the intervention), and the incremental costs per quitter. In addition, researchers evaluated the process of transferring to practitioners the attitudes, knowledge, skills, and system supports required. Implementation outcomes, such as the barriers and facilitators to clinicians' implementation of smoking cessation guidelines and the factors mediating the adoption of recommended practices (eg, clinician self-efficacy for providing smoking cessation) were also examined.

Dissemination research outcomes suggested by models within thematic area 4 and evaluated in studies of tobacco cessation interventions include implementation fidelity, treatment potency, patient and clinician acceptability or satisfaction with the interventions, and cost effectiveness.[110-112] Illustrating this, Kobus and Mermelstein describe the Partners with Transdisciplinary Tobacco Use Research Centers (TTURCs) Partners initiative.[113] The initiative was developed to fill the gap between scientific discovery and research translation, extending basic and applied research in tobacco cessation through studies that examine the policy and practice implications of specific tobacco cessation interventions. The research emphasizes the extent to which findings from tobacco dependence studies are transferable to real-world settings and serve to enhance policy development. For example, TTURC Partners' studies have explored the factors associated with physicians' receptivity to adopt novel smoking cessation approaches into practice and have examined the health economics of tobacco cessation from the perspective of the employer (eg, impact of cessation on worker productivity and reduced health care expenditures).[113] Ritzwoller and colleagues have similarly described the importance of including cost analyses in trials of smoking cessation interventions to develop more precise and generalizable implementation cost estimates for behavioral interventions, because settings can have unique needs relative to intervention resources.[114]

DISCUSSION AND IMPLICATIONS

We have argued that despite an expanding number of conceptual models, theoretical development relative to EBP, knowledge utilization, and translational science in nursing has been attenuated. There is an abundance of terminologies in use, and in some circumstances the same terms are applied but with different meanings.[115] Without conceptual clarity, this expanding literature base complicates rather than advances the use of theory in translational research. Using comparative analysis, our purpose has been to illuminate the span of theoretical models available to inform knowledge development, transfer, and utilization. This analysis has also attempted to map the significant convergences among conceptual models within each thematic area and the linkages among thematic areas. Further, it has advanced the recommendation that an eclectic, pluralistic approach to model usage is necessary to accelerate the development of new knowledge and the application of evidence by practitioners and policymakers.

We acknowledge that in an effort to place the models within discrete categories, we may have enlarged the separation between the thematic areas. Each identified thematic area is not fully discrete, and several of the models incorporate elements from more than one thematic area. For example, most models that focus primarily on EBP and the transformation of research findings into knowledge useful for clinical practice also mention the importance of the change process and facilitation (eg, EBP mentors,[116-118] organizational readiness,[119] factors that affect the adoption of innovation,[11] and the importance of a supportive infrastructure[120]). However, EBP models are not explicitly focused on providing theory that explains the mechanisms for uptake and adoption, as in thematic area 2, or the mechanisms for awareness and acceptance of an innovation, as in thematic area 4.

The conceptual model selected to guide a specific knowledge translation initiative substantially influences the aims, design, methods, and evaluation of outcomes.[1,21,121] Science leaders should carefully examine

the phenomenon of interest and select models that address all aspects of a phenomenon. For example, the singular use of models that emphasize the problem-solving approach of EBP may fail to fully account for the processes of strategic change and aspects of organizational climate and culture that impact the adoption of innovation. Moreover, at specific stages in the translational science continuum, models from one thematic area may perform better than those from another thematic area. For example, models that emphasize the design of dissemination research or those that emphasize the process of strategic change may offer greater specificity in selecting variables and interpreting study results than models that emphasize the process of bidirectional exchange between researchers and clinicians. On the other hand, where integration and dialogue across disciplinary boundaries is needed, models emphasizing knowledge exchange, synthesis, and application might be most suitable. A thoughtful, flexible approach to model selection is necessary to advance the use of theory in translational science.

Although there are multiple models for EBP and substantial areas of convergence across those models, less attention has been given to theoretical development in the areas of knowledge exchange and dissemination research. The results of this analysis can be incorporated to promote continued evolution of the current models for EBP and to encourage theoretical developments that promote a level of multidirectional engagement among all stakeholders (practitioners, consumers, administrators, policymakers, community leaders, and researchers) and benefit decision making for all involved parties. Several recent papers summarizing the state of the science in treating tobacco dependence,[122] proposing an agenda for tobacco dependence research,[123] and outlining an agenda for public policy in the area of tobacco cessation[124,125] offer examples of this capacity for the thematic areas to promote problem framing and policy making.

The prominence of EBP models in the nursing literature raises the question about whether the discipline's approach to translational science has been constrained by an over-emphasis on models in thematic area 1. We do not suggest that, as nursing reaches higher levels of scholarly engagement in translational science, models focused on EBP or on strategic change to promote adoption of knowledge should be abandoned. Rather, we urge leaders to use theory as a tool for translational science and to apply a flexible theoretical stance to guide their work. Evolution toward a pluralistic, conceptual approach for translational science encompasses both strategies to facilitate practitioners' efficient access to research evidence and point-of-care decision support, together with interventions to sustain an organizational culture that is "research-minded,"[8,121,126] Flexible pluralism also supports the development of actionable messages for decision makers such as public policymakers, health managers, and corporate executives; the development of knowledge uptake skills in target audiences and knowledge transfer skills in research organizations; and the systematic evaluation of the impact of knowledge translation activities by both service delivery and research organizations. Thus, a pluralistic approach gives simultaneous attention to creating organizational cultures and climates that favor the adoption of innovation, and to strategies that create greater proximity, dialogue, and affinity between the generation of knowledge by researchers and its application by health professionals, patients, communities, and public policymakers.[127,128] Within a stance of theoretical pluralism, leaders consciously select, depending on setting, context, and purpose, from this full range of theoretical models to guide translational science efforts.

Adoption of a pluralistic theoretical approach to translation has implications for clinicians, administrators, educators, and researchers. For clinicians seeking to improve clinical outcomes through the application of best evidence, EBP and RU models offer a systematic approach to clinical decision making.[129] However, one limitation of these models is that many place comparatively less emphasis on outcomes evaluation and on the features of an organization that promote the adoption of innovation.

Advanced practice nurses and nurse researchers can utilize the thematic areas to provide context for their respective involvements in knowledge translation efforts. For example, models in thematic area 3 that emphasize a bidirectional collaboration between researchers, clinicians, and policymakers offer a useful context for researcher-clinician collaboration in tailoring and then testing an intervention in a naturalistic setting.

Theoretical pluralism is a particularly essential skill for the researcher. Sales et al have argued that without explicit attention to theory, study findings are difficult to interpret, and essential implementation strategies needed to promote a practice change may be overlooked.[121,130] Researchers can use models in thematic area 4 to identify the mediators, moderators, and outcomes that should be examined when testing the effectiveness of an intervention in a population or to distinguish in an implementation trial the individual and organizational features that promote adoption of an innovation into routine care settings.[47]

Although we and others[3,4,7,27,121,131,132] have attempted to place some conceptual structure and parsimony on the large number of available models for EBP and translational science, there remains a need for these models to be tested and refined through empirical study. There is also a continued need for nursing, as a discipline, to give attention to the lexicon for translational science. Within the field of translational science more generally, there are considerable inconsistencies in terminology and meaning.[84,133] Evolving a shared understanding of these inconsistencies

within and across research/practice sectors will take interdisciplinary collaboration, and such efforts are in progress.[4,8,134-137] However, to contribute effectively to that dialogue, nursing leaders must be equipped with a sufficiently broad and nuanced understanding of the concepts, terminology, and controversies within and across practice and research sectors. Lastly, graduate curricula must include an exposure to the theory base,[138-141] methods,[83,142-150] and lexicon[151-158] for translational science so that emerging leaders are equipped to take a flexible conceptual approach to research design, leadership, and change management across the translation continuum.

CONCLUSION

This thematic analysis maps the diversity of conceptual approaches to translational science. It arranges the models into thematic areas, making it easier for leaders and researchers to access theory and to narrow or broaden the set of models they consider to guide their work. Rational selection of a conceptual model to guide a specific initiative in translational science is predicated on familiarity with models in all four thematic areas. Knowledge translation theories for the health sciences are in need of continued testing and refinement. At the same time, fostering theoretical pluralism is essential if we are to simultaneously advance EBP and translational science. This flexible, pluralistic approach may also mitigate the individual and organizational challenges encountered in translating evidence into practice behaviors and programs of care that optimize individual and community health outcomes.

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