Theory and Practice of Using Mixed Methods in Translational Research: A Cross-disciplinary Perspective

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ABSTRACT

Translational research is a cornerstone to evidence-based practice and improvement science. The major premise of translational research is that evidence-based generated results should be translated and adopted in practice to benefit the health and well-being of the population. However, slow adoption rates and significant delays in translation time call for more effective methods to facilitate adoption, dissemination, and implementation of research findings into everyday practice. Mixed methods research that meaningfully integrates qualitative stakeholder engagement methods with quantitative outcome-based oriented approaches provides a rigorous methodological foundation for translational research. This article discusses the use of mixed methods in translational research and describes five interdisciplinary methodologies—evidence-based practice, adaptation, dissemination and implementation, community-based participatory research, and action research—that jointly facilitate the translation of research findings into practice. The intersection of mixed methods research with each of these methodologies expands their scope and adds rigor to the assessment of the translational research process and its outcomes. The article introduces a mixed methods action research methodological framework for translational research and illustrates its application using an example of a mixed methods translational research study from nursing practice. The framework integrates mixed methods into each step of the community-based participatory action research process and captures the synergistic interplay among the five methodologies at different stages in the translational research process as informed and enhanced by mixed methods research, thereby providing a solid theoretical foundation for promoting sustainability of the knowledge translation process.

KEYWORDS

Action research; adaptation; community-based participatory research; evidence-based practice; implementation and dissemination; mixed methods research; translational research

An exponential growth in recognition and use of mixed methods research across disciplines and epistemological paradigms (Alise & Teddlie, 2010; Coyle et al., 2016; Creswell, 2015; Ivankova & Kawamura, 2010; Johnson, 2017) point to its methodological potential in supporting other forms of inquiry, such as translational research. Translational research (TR) is commonly defined as research aimed at moving knowledge and discovery obtained from the basic sciences to its application in clinical and community settings (Clinical and Translational Research Institute [CTRI], n.d.). More broadly, TR is viewed as “inquiry that breaks new ground by uniting a concern for fundamental principles with a concern for everyday problems and outcomes” (Mace & Critchfield, 2010, p. 296). Although TR has gained increased awareness after the National Institutes of Health (NIH) prioritized it in 2006 as a way to bridge the gap between research and practice, TR “is as old as science itself” (Mace & Critchfield, 2010, p. 296) and has been widely used across disciplines.
The major premise of TR is that evidence-based generated results should be translated and adopted in practice to benefit the health and well-being of the population. Translating research findings into practice has always been the goal of science. However, slow adoption rates, significant delays in translation time, and frequent mismatches of interventions with target populations and communities (Chambers & Norton, 2016; Ioannidis, 2004; Kajermo et al., 2010) have led to a call for “more effective methods of encouraging adoption, dissemination and implementation” of research findings—methods that will “take into account the organizational, clinical, and social environments that affect uptake of research” (C. A. Green et al., 2015, p. 508). Moreover, designing, adapting, implementing, and disseminating research that is aimed at enhancing the adoption of evidence-based generated practices in the community should be undertaken in partnership with key stakeholders whose views, experiences, and needs uniquely shape the TR process.

The mixed methods research approach that meaningfully integrates qualitative stakeholder engagement methods with quantitative outcome-based oriented approaches can provide a rigorous methodological foundation for TR (Ivankova, 2015, 2017). The critical role of mixed methods in advancing knowledge of adaptation, implementation, and dissemination research has been well-recognized (Brownson, Colditz, & Proctor, 2012; Creswell, Klassen, Plano Clark, & Smith, 2011; C. A. Green et al., 2015; Palinkas et al., 2011). By mixing quantitative and qualitative methods within a single study, researchers can increase the breadth and depth of understanding (Johnson, Onwuegbuzie, & Turner, 2007) of the pertinent issues related to the process of knowledge translation and, thus, produce more valid study outcomes (O’Cathain, 2010; Onwuegbuzie & Johnson, 2006). The ability of mixed methods research to address a range of knowledge generation and knowledge verification questions within a single study (Teddle & Tashakkori, 2009) makes it a viable methodological approach for exploring the issue at different levels, from different perspectives and for providing contextual understandings shaped by real-life experiences and cultural influences (Creswell et al., 2011; Morse & Niehaus, 2009; Nastasi & Hitchcock, 2016; Teddle & Tashakkori, 2009). Additionally, mixed methods research has methodological flexibility to intersect or to be meaningfully integrated with other research approaches and designs (Plano Clark & Ivankova, 2016), for example, action and participatory research allowing for the study of both the course and outcomes of the issue using cyclical action-oriented and community-based methods, thereby facilitating the process of translating research into practice. The purpose of this article is to discuss the use of mixed methods in TR, to describe a mixed methods methodological framework for enhancing translation of research findings into practice, and to illustrate the framework application using an example of a published mixed methods TR study from nursing practice. We begin by discussing TR and five methodologies that play an important role in the process of translating research into practice and that shape the methodological and decision-making processes underlying the use of mixed methods in TR.

**Translational Research**

TR is a cornerstone to evidence-based practice (EBP) and improvement science. TR is defined in different ways, dependent on a researcher’s perspective, specific discipline, and professional engagement. Generally, TR embraces three sets of concepts: translating knowledge from the basic sciences into the development of new treatments and programs, referred to as T1 research; translating the research findings into everyday practice, referred to as T2 research; and translating the research findings to the community, referred to as T3 research (Abernethy & Wheeler, 2011; Woolf, 2008). Using the skills in translational science, the investigator integrates EBP, clinical experiences, and the individuals’ preferences to best produce outcomes that impact population and system’s level care and well-being (Taylor, Priefer, & Alt-White, 2016).

TR emerged in the medical field stimulated by concerns over the long time that it takes to incorporate scientific discoveries in treatments, practices, and health policies (Wethington & Burgio, 2015). An NIH-sponsored initiative called the Roadmap was created in 2006 to underscore the emphasis of translating basic science research to human studies and to expedite treatments or diagnostic testing for clinical practice that would improve patient outcomes. Translational research centers sponsored by NIH institutes and the Clinical and Science Translation Award have emerged to train and cultivate the translational science workforce and to engage patients and communities in every phase of the innovation translation process in order to increase the quality and efficiency of TR (National Center for Advancing Translational Sciences [NCATS], 2015).

TR is described as a complex process that necessitates both research activities and implementation work (Layde et al., 2012)—a process that is more cyclical than linear (Callard, Rose, & Wykes, 2012). That is, researchers look to practitioners to provide feedback in the translation process in order to benefit clients. T1 research primarily is biological, methodological, and technological, whereas those of T2 and T3 involve the nuances and messiness of human and organizational behavior. Moving from basic scientific discoveries to changes in clinical
and professional practice and true translation of research findings in community settings requires two fundamental elements: information flow (availability and accessibility of data to guide change and transformation) and behavioral change. Behavioral changes require new communication patterns, and novel ways of using data and providing services. Mixed methods research offers real possibilities for bridging the T1 to T3 gaps and for evidence-based interventions to efficiently and effectively reach individuals and populations benefiting from the improvements (Abernethy & Wheeler, 2011).

TR is about knowledge translation and transformation. Knowledge synthesis plays an essential role in all phases of the TR process, from discovery to impact on population health and well-being (Khoury, Gwinn, & Ioannidis, 2010). Meta-analyses and systematic reviews are examples of knowledge synthesis methods at the T2 and T3 levels because they support evidence-based recommendations for practice. Two critical skills for knowledge translation, as reported by Woods and Magary (2010), are team science and transdisciplinary efforts. No longer are researchers disseminating in isolation, focusing on a single problem within a single discipline, because the relevance of their work might not translate well in real time and in real settings. That is why transdisciplinary work necessitates an interdisciplinary approach, focusing on shared problems (Woods & Magary, 2010).

In the following sections, we describe five methodologies that we believe are important to consider during the process of translating research into practice. They comprise use of EBP, adaptation, dissemination and implementation, community-based participatory approach, and action research. These are not the only methodologies that shape the TR process; other approaches to research and practice might be equally important to consider and include in further discussions. However, we believe that these five methodologies are integral to the TR process as they help bring research findings to clinical and community settings, thereby addressing the needs of T2 and T3 research. These methodologies can be also easily intersected or integrated with mixed methods research, which we illustrate by using published mixed methods studies in different disciplines.

Evidence-Based Practice

Evidence-based practice is a process of clinical decision-making that integrates best scientific evidence, clinical expertise, and clients’ values and characteristics. Originated in medicine as evidence-based medicine, EBP has expanded into a “transdisciplinary, idiographic approach that promotes lifelong learning” (Spring, 2007, p. 611). Oxman et al. (1993) introduced EBP as critical for establishing the scientific basis for healthcare decisions. Translating research evidence into clinical practice was seen as the overarching goal of EBP necessitating thoughtful searching for high levels of research evidence and appraisal to make informed clinical decisions. Since then, EBP has become an inter-disciplinary and cross-country movement for transparency and accountability aimed at facilitating the translation of scientific knowledge into practice. For example, in the United States, the Institute of Medicine (IOM) produced the Crossing the Quality Chasm report promoting EBP as a means to address medical errors causing significant preventable harm (IOM, 2001). In Great Britain’s education, the push for EBP was prompted by critical reports about educational research commissioned by the Department for Education and Employment and the Office for Standards in Education (Biesta, 2007).

Similar to TR, EBP is geared to using current knowledge and best practices to inform improvement initiatives, processes, and outcomes. EBP mandates that practitioners use findings from the most rigorous, well-designed, and carried out research studies on assessments and treatments to inform their clinical practice (Babione, 2010; Melnyk, Fineout-Overholt, Stillwell, & Williamson, 2010). EBP involves aligning the merit of each aspect of research evidence with the individual participant’s (e.g., patient) data, choices, and values. In health care, particularly, engaging patients in evidence to support best treatment options facilitates clinical decision making and informed patient choices. This adds credibility and trust in relating to patients’ best options in their care (Melnyk et al., 2010).

Rycroft-Malone et al. (2004) described the need for several sources of evidence—research, clinical experience, patient experience, and information from internal system’s data—that help bring together the external, scientific and the internal, intuitive approaches to care. Melnyk et al. (2010) outlined seven steps to the EBP in health care that can be applicable to any practice-oriented discipline:

• creating a culture of inquiry;
• asking the clinical question;
• searching and finding the best evidence;
• critical appraising of the evidence;
• identifying patient preferences and values along with provider expertise for integrating the highest level of evidence;
• evaluating the outcomes for EBP; and
disseminating the results of practice-based evidence.

Several models of EBP have been advanced in the health care literature, including the following: Iowa Model of Evidence-Based Practice, Johns Hopkins Nursing Evidence-Based Model, and the ACE Star Model for Knowledge Transformation (Stevens, 2013). These models provide a framework for stepping through the EBP process, beginning with the need for EBP update (gap, area for improvement) through the dissemination and spread process.

Maloney et al. (2015) conducted a mixed methods research study to determine the efficacy of social media as an educational medium to effectively translate EBP into clinical settings with the ultimate goal of changing clinicians’ knowledge and behaviors. The study involved the use of a pre-intervention/post-intervention design and included 317 clinicians from multiple health disciplines at five research sites across the United Kingdom, Australia, the United States, India, and Malaysia. During the two-week time, participants had to engage with studying EBP points relevant to their area delivered via Twitter or Facebook social media platforms. Quantitative questionnaires were used to evaluate the changes in clinicians’ attitude, knowledge, and behavior, whereas qualitative data from open-ended responses provided additional insights about the intervention impact on the clinicians’ practices. The evaluation results allowed the researchers to conclude that social media could serve as an effective educational medium for delivering EBP and improving knowledge translation.

Adaptation

Adaptation is the degree to which an innovation is undergoing adjustments or modifications in the process of its adoption and implementation in real-life settings (Rogers, 1995). The concept of adaptation is based on Rogers’ (1995) diffusion of innovations theory that seeks to explain how a new idea, product, or practice is adopted by certain members of society. McKleroy et al. (2006) identified the following reasons for innovation adaptation:

- to simplify a complex innovation;
- to address a lack of knowledge about the innovation;
- to focus in on a specific problem or expanding to other problems;
- to increase stakeholders’ ownership of the innovation;
- to address more diverse populations;
- to choose an appropriate form of innovation delivery;
- to respond to a change initiated by agency; and
- to fit the available resources.

In each case of adaptation, it is important to preserve the core components that account for the quality and integrity of the innovation.

Adaptation has been extensively discussed in the literature as an important component for translating evidence-based research into practice, and specifically for enhancing evidence-based health intervention effectiveness (Brownson et al., 2012; Chambers & Norton, 2016; Resnicow, Soler, Braithwaite, Ahluwalia, & Butler, 2000). Several models of adaptation have been advanced in the literature to explain and guide the adaptation process, including the following: ADAPT-ITT Model (Wingood & DiClemente, 2008), Cultural Adaptation Model (CAM; Domenech Rodríguez, Baumann, & Schwartz, 2011), and Disparities Reduction Agenda Model (DRAM; Kilbourne, Switzer, Hyman, Crowley-Matoka, & Fine, 2006). To be effective, an intervention should be adapted “to fit the cultural context in which the intervention will take place, individual determinants of risk behaviors of the target population, and the unique circumstances of the agency and other stakeholders” (McKleroy et al., 2006, p. 62).

Moreover, an intervention requires contextual knowledge of the target population’s experiences with the studied issue; it should be responsive to the cultural practices and fit the worldviews of the targeted group (Resnicow et al., 2000; Wingood & DiClemente, 2008).

Reportedly, adaptation can increase the fit of the intervention to a targeted population by taking into account the influences of the contextual factors, such as sociocultural, political, economic, and environmental that might influence the innovation uptake (Allen, Linnan, & Emmons, 2012; Chambers & Norton, 2016). Characteristics of the target population, the parties responsible for the innovation delivery, the unique circumstances and characteristics of the organization and setting, and available resources—all can play a significant role in how the innovation is viewed and adopted by a specific group and in a specific community (Cohen et al., 2008).

Adaptation is not a one-time event. It is an active process that begins with assessing the knowledge about the intervention and is integrated in the entire process of intervention dissemination and implementation to ensure the buy-in of all interested stakeholders (McKleroy et al., 2006). Contrary to a one-size-fits-all approach to intervention delivery, adaptation is embedded in the context of intervention implementation and monitoring to
maximize the intervention fidelity and to ensure that the intervention is delivered as it was originally designed and planned by the developers (Chambers & Norton, 2016).

Baydala et al. (2014) reported on the cultural adaptation of the school-based drug and alcohol abuse prevention program for an Aboriginal community in Central Alberta, Canada. The Life Skills Training Program was chosen as a viable model for potential adaptation and adoption in the community. Using a Community-based participatory research (CBPR) approach, researchers engaged community members in the process of cultural program adaptation emphasizing community values, cultural perspectives, and measurable short- and long-term outcomes. The Adaptation Committee, including school personnel, community representatives, and the Elders, was formed to guide the adaptation process. The program was delivered to elementary and junior high students at the Alexis Nakota Sioux Nation School and its impact was evaluated using a mixed methods research approach. The data were collected from focus groups involving school representatives, community members, and the Elders, and a longitudinal survey of students to reveal the program fidelity and its positive impact on students and the community.

Dissemination and Implementation

Dissemination and implementation (D&I) refer to “social and organizational processes by which new scientific discoveries and advances can be translated and transferred to people, settings, and communities” with the purpose of improving people’s health and well-being (Luke, 2012, p. 155). The aim of D&I research is to facilitate the adoption of EBP in real-world settings by identifying factors and strategies that help reduce time for the innovation uptake (Tabak, Khoong, Chambers, & Brownson, 2012). Dissemination is an integral part of the D&I process. It focuses on identifying the means to communicate research results to various stakeholders using different venues that are adapted to the needs and preferences of the target audiences (Marín-González, Malmusi, Camprubi, & Borrell, 2017). Such adaptation increases efficacy of EBP implementation taking into account cultural-, linguistic-, socioeconomic-, gender-, and age-related factors.

Successful implementation of EBP depends on the combination of many factors, which include, but not limited to, how implementation progress is organized within a unit, such as a hospital (Van Noord, De Bruijne, & Twisk, 2010), employee’s attitude to their job responsibilities (Butts, Vandenberg, Deloy, Schaffer, & Wilson, 2009), employer’s leadership style (Markle-Reid et al., 2017), and administration’s readiness to EBP implementation (Ober et al., 2015). When the implementation is poorly organized or is partially carried out, it can lead to inconsistent use of EBP across target populations and settings, unbalanced utilization of the intervention core components, and application of wrongful treatment programs or procedures. All these issues impede knowledge transfer and wider implementation of EBP among consumers. Damschroder et al. (2009) advanced a comprehensive Consolidated Framework for Implementation Research (CFIR) which includes major constructs that influence implementation, such as characteristics of the intervention, participants, setting, and the process itself.

Therefore, evaluation of implementation outcomes is critical in the D&I research and relies on both qualitative and quantitative approaches. Evaluation of implementation results is based on three types of outcomes: implementation itself, service, and client (Proctor et al., 2011). These outcomes are aimed at translating EBP, promoting a participant-centered approach, and ensuring sustainability of effective treatments and programs. Additionally, assessment of outcomes depends on the phase of implementation, attitude to the outcomes, and interests of an organization. For example, treatment feasibility is an important outcome during the initial stages of implementation; however, once the treatment becomes routine, feasibility becomes an expectation based on the systematic approach used (Proctor et al., 2011). The Reach Effectiveness-Adoption Implementation Maintenance (RE-AIM) framework offers a comprehensive approach to guide the implementation evaluation and to identify areas for potential improvement (Glasgow, Vogt, & Boles, 1999).

Glasgow et al. (2012) reported on the implementation, dissemination, and adaptation process of integrating information from a web-based diabetes self-management program for adults into primary care and the electronic health record. The study addressed the critical aspects of translating evidence-based knowledge about the benefits of interactive health communication applications to improve patient-provider communication and information exchange about diabetes self-management issues. The study was conducted at 14 primary care clinics within an integrated managed care organization Kaiser Permanente Colorado. The web-based diabetes self-management support program “My Path To Healthy Life” was implemented with 76 primary care providers and 331 Type 2 adult diabetes patients who were randomly assigned to one of the two program venues. Mixed methods research was used to evaluate the program implementation into primary care and to inform the necessary adaptations. The results from a patient satisfaction survey, medical charts reviews, qualitative interviews with physicians, and descriptive notes about the program implementation process demonstrated the need for
more enhanced integration of patients’ information into practice work flow and existing electronic health record systems.

Community-Based Participatory Research

Community-based participatory research (CBPR) is “a systematic inquiry, with the collaboration of those affected by the issue being studied, for purposes of education and taking action or effecting change” (L. W. Green & Mercer, 2001, p. 1927). CBPR is a collaborative, partnership approach to research that equitably involves all community members including recipients of interventions, practitioners, service agencies, community leaders, policymakers, and other stakeholders in all phases of the research process (Israel, Schulz, Parker, & Becker, 2001; Minkler & Wallerstein, 2003). Community is defined broadly as inclusive of all who will be affected by the research results and who have a stake in the studied issue. Specifically, community is recognized as a social and cultural entity with the active engagement and influence of all community members. In CBPR, all partners contribute expertise and engage in the process of investigation to find effective solutions to resolve the problem. By doing so, they share decision making and ownership in the research process, thereby creating what Stringer (2014) referred to as the “community of interest” (p. 6).

The core principles of CBPR include the following:

- recognizing community as a unit of identity;
- building on strengths and resources within the community;
- facilitating collaborative, equitable involvement of all partners in all phases of the research;
- integrating knowledge and action for mutual benefit of all partners;
- promoting a co-learning and empowering process that attends to social inequalities;
- involving a cyclical and iterative process;
- addressing health from both positive and ecological perspectives;
- disseminating findings and knowledge gained to all partners; and
- involving a long-term commitment by all partners (Israel, Schulz, Parker, & Becker, 1998; Israel et al., 2001).

Being originally developed for public health, these principles have been applied in numerous ways by researchers in different fields to guide the CBPR process. Observing these principles increases the likelihood that research findings will be accepted and readily implemented in communities. Additionally, because CBPR is iterative and cyclical, strong and long-lasting partnerships can emerge between researchers and stakeholders during the research process (Faridi, Grunbaum, Gray, Franks, & Simoes, 2007). Performing research in collaboration with those affected by the issue for the purpose of making change can enhance the chances for intervention adoption and sustainability in targeted communities (Royal Society of Canada, 1995).

Craig (2011) conducted a CBPR project aimed at developing a system of care for gay, lesbian, bisexual, transgender, and questioning (GLBTQ) youths in an urban area. A CBPR approach was necessary to create collaborative partnerships with local agencies to assess existing health and mental health service delivery systems for GLBTQ young people in the community in order to inform the development of an effective system of care. The study was conducted in Miami Dade County, Florida, in collaboration with six agencies that had programs for GLBTQ young people. Mixed methods research was used to inform a sequential data collection and analysis in order to enhance the credibility of the findings from the entire study. Qualitative results from the initial environmental scan and key informant interviews with 45 stakeholders guided 10 focus group discussions with GLBTQ youth in the community. Subsequently, a quantitative survey instrument “Youth Speak Out” was collaboratively developed grounded in the qualitative results from the interviews and focus groups. Each draft of the survey was reviewed by a Youth Advisory Board that consisted of 10 youth representatives from the target population. The survey was administered to a representative sample of 273 GLBTQ youths in the county and the findings were presented to the community members to solicit their feedback as well as identify and implement particular services for GLBTQ young people.

Action Research

Action research is a popular cross-disciplinary methodological approach that focuses on seeking solutions to practical issues, generating evidence-based knowledge for improving practice, and empowering participants for change action (Hacker, 2013; Koshy, Koshy, & Waterman, 2011; McNiff & Whitehead, 2011). A pragmatic focus and flexibility of action research has attracted researchers from different fields who took advantage of action research in “studying, reframing and reconstructing social practices” (Kemmis & McTaggart, 2008, p. 277). Stringer (2014) defined action research as “a systematic approach to investigation that enables people to find
effective solutions to problems they confront in their everyday lives” (p. 1), whereas in the *Sage Handbook of Action Research*, action research is described as “a participatory process concerned with developing practical knowing in the pursuit of worthwhile human purposes” (Reason & Bradbury, 2008, p. 4). Action research “seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people” (p. 4).

The term *action research* was introduced by Kurt Lewin (1948), who viewed action research as a cyclical research process that consists of four iterative stages of reflecting, planning, acting, and observing. The cycle begins with identifying a practical issue of pertinent importance and reflecting on its potential solutions. This step involves reconnaissance or fact finding about the situation that leads to planning and testing an action, or taking the first action step, which is followed by evaluating the initial plan and revising or modifying it for the next action step. The process involves reflection on the action outcomes and what needs to be improved or changed for the next action step (see Figure 1). The action research cycle is repeated as many times as needed until the issue is resolved.

![Figure 1. Lewin’s methodological steps in the action research process. Note: Based on Lewin (1948). Reprinted from Ivankova (2015) with permission of Sage Publishing.](image)

Methodological characteristics of action research are closely related to its dynamic character and cyclical nature, thereby resulting in a systematic and flexible research process that involves collection of multiple data sources and generation and testing of an action (Hinchey, 2008; Stringer, 2014). Action is central to the idea of action research and requires a spiral of action cycles aimed at developing, implementing, and evaluating an action plan to improve practice (Kemmis, 1982). Observing and reflecting on the effects of action and using this information for planning subsequent action cycles provides an evidence-based approach to “jump-start” the process of translation and adoption of the generated evidence into practice (Hacker, 2013, p. 103).

Kostos and Shin (2010) used action research to investigate how the use of mathematics journals affected second-grade students’ communication of mathematical thinking. An action research approach was chosen because it allowed the teacher-researcher to capture students’ thinking process more closely and to collect and analyze the information in more depth by conducting research in her own classroom. The study was conducted in a second-grade mixed-ability classroom in a suburban school in Chicago and followed traditional action research steps of reflecting, planning, acting, and observing. Mixed methods research was used to evaluate the effectiveness of mathematics journaling instruction by concurrently collecting and analyzing data from multiple quanti-
tative and qualitative sources, such as students' scores on mathematics assessments, mathematics journal entries, interviews with eight randomly selected students, and the teacher's reflective journal. The integrated quantitative and qualitative findings provided evidence that mathematics journaling enhanced student learning.

Applying Mixed Methods in Translational Research

Conceptual Model for Intersecting Mixed Methods with Translational Research

As we have demonstrated in the earlier sections, the five methodologies—EBP, adaptation, D&I, CBPR and action research—play an important role in, and provide unique contribution to the process of translating research findings into practice. What is equally important is that these methodologies, similar to Rothman's causal pies in disease epidemiology (Rothman & Greenland, 2005), are not mutually exclusive. They often interact, intersect, and influence each other in their joint effort to promote and facilitate the TR process. Indeed, successful dissemination and implementation of research into practice depends on the nature of provided evidence, the contextual environment, and the mechanism by which the process is implemented in real-life settings (Kitson, Harvey, & McCormack, 1998), whereas community and stakeholder engagement is critical for ensuring evidence-based innovation is accepted and adopted. The process of innovation adaptation is integrated into the D&I process and relies on stakeholders' involvement and active participation in all stages through the use of CBPR methods (Allen et al., 2012). Action research with its experiential learning, dynamic nature, and focus on the issues relevant to community provides a foundation for CBPR (Faridi et al., 2007). Knowledge translation process is often iterative and involves cycles of observing, reflecting, planning, and acting to ensure that evidence-based generated findings are reflective of stakeholders' views and experiences and are aimed at benefiting those affected by the issue (McNiff & Whitehead, 2011).

Figure 2 presents a conceptual model for intersecting mixed methods with TR which captures the interaction of the five methodologies within a larger TR framework. We assign the center role to mixed methods research because it insects with all five methodologies and provides them with methodological support that capitalizes on the meaningful integration of quantitative and qualitative methods. Such intersection enhances TR in several ways: it helps generate more valid inferences to inform the need and direction for innovation adaptation; it helps secure a more systematic approach to innovation exploration, evaluation, dissemination, and implementation; and it helps provide a solid ground for promoting sustainability of innovation in the community. Furthermore, a pragmatic nature of mixed methods research makes it advantageous in illuminating and assessing change over time without sacrificing the credibility and validity standards (Perry, 2009).

In the following sections, we discuss in more detail how mixed methods can inform TR using community-based participatory action research to enhance the processes of innovation adaptation, dissemination, and implementation grounded in EBP. We describe the mixed methods methodological action research framework for TR and illustrate its application on a study from nursing practice.

Mixed Methods Action Research Methodological Framework for Translational Research

The mixed methods action research (MMAR) methodological framework was originally advanced by Ivankova (2015) to facilitate application of mixed methods in community-based action research for addressing issues of practical importance. Later, this framework was applied in nursing research as a means for promoting patient-centeredness and enhancing stakeholder engagement with research and its outcomes (Ivankova, 2017). Because the focus of the framework is to assist stakeholders in developing better appreciation for data-driven, decision-making process by capitalizing on the advantages of integrating quantitative and qualitative methods, we believe that this framework has the capacity to inform research that aims at translating generated evidence into practice. Additionally, the framework helps one to understand how a synergistic combination of qualitative stakeholder engagement methods with quantitative outcome-based oriented approaches can be used for developing evidence-based, scientifically sound, and participant-centered plans for improvement, thereby enhancing TR from inception to adoption, spread, and sustainability.
The MMAR methodological framework for TR depicted in Figure 3 conceptually follows the cycle of action research methodological steps outlined by Lewin (1948) and integrates mixed methods into each step in the community-based participatory action research process. The framework consists of six iterative phases with clearly defined boundaries—diagnosing, reconnaissance, planning, acting, evaluation, and monitoring. The phases follow each other sequentially within a cycle reflecting Lewin’s action research methodological steps; however, they also interact with each other in multiple ways depending on the purposes and needs of TR. During each phase, methodological and procedural components of mixed methods research are used to inform and enhance each step in the community-based participatory action research cycle. The cycle is further embedded in the processes of adaptation, dissemination, and implementation that help translate the innovation informed by EBP. Because adaptation, dissemination, and implementation are ongoing until the innovation is adopted and its sustainability is established in the community or practice, these processes can strategically influence the purpose and design of each phase in the community-based participatory action research cycle.
Figure 3. MMAR methodological framework for translational research.

During the diagnosing phase, the issue requiring improvement for a specific group or community using evidence-based solutions—such as reducing smoking, promoting healthy eating, or increasing academic achievement—is identified and the study is conceptualized. The use of mixed methods research in this phase helps provide a methodological framework for developing research questions that rely on the integration of quantitative information with qualitative data generated with stakeholders’ input to obtain more complete results. The next, reconnaissance phase focuses on obtaining information about the specific needs of the target groups (e.g., cancer survivors, obese children, or low-achieving high school students), and the assessment of the community resources necessary for disseminating and implementing an innovative program or intervention. Integrating quantitative and qualitative methods using established mixed methods designs helps to identify the necessary adaptations of the program or intervention to the target population needs and to inform the development of the action plan for innovation delivery. The planning phase involves critical reflection on the results from the mixed methods assessment of the issue, sharing these results with the key stakeholders from the community (e.g., caregivers, parents, hospital administrators, community leaders, superintendents and school principals), and designing an action based on these interpretations and reflections.
During the acting phase, the action is taken to start the process of innovation adaptation and implementation. If the program or intervention has already been used in the community, action is directed to its further refinements and adjustments moving the intervention from feasibility testing to beta and efficacy testing. The next, evaluation phase focuses on a rigorous evaluation of the implemented action to learn whether it has produced the desired outcomes that were set at the planning phase and what further adaptations in the intervention delivery might be necessary (e.g., changing the communication venue, controlling for unexpected barriers, or providing individual tutoring within a high school curriculum). During this phase, an evaluation mixed methods study can be designed to inform the collection and analysis of the quantitative and qualitative data and interpretation of the integrated quantitative and qualitative results.

Finally, the focus of the monitoring phase is on making informed decisions about whether revisions or further testing of the intervention is necessary to enable its successful sustainability in the community. Mixed methods inferences that were generated during the evaluation phase guide decisions about further adaptation and D&I process necessary to reach desired outcomes. If the intervention or program is successful, continuous mixed methods evaluation of its progress can promote further monitoring and sustainability, thereby enabling transferability of the evidence-based results to other contexts and community settings. Alternatively, if the desired outcomes are not achieved, a decision can be made either to revise an action plan using the results from a mixed methods evaluation, or to return to the diagnosing and reconnaissance phases to better conceptualize the problem by conducting more in-depth mixed methods exploration of the issue so as to inform the plan revisions. Such cyclical, dynamic, and iterative nature of the community-based participatory action research supports the TR continuum and increases chances that the innovation will be accepted and used in the community.

Consistent with the principles of the community-based participatory action research, each phase in the MMAR methodological framework for TR involves collaboration with research participants and interested stakeholders whose active involvement can provide support and buy-in for the project success in the community. Stakeholders can be engaged in multiple roles and participate in the study conceptualization, planning, implementation, and evaluation, as well as help with disseminating the study results in the community. Through this engagement, stakeholders feel respected and more empowered to make the best decisions regarding the important issues, such as their health and well-being, and help improve the outcomes that are most important to them (Eisinger & Senturia, 2001; Israel et al., 2001).

Application of MMAR Methodological Framework for Translational Research

In this section, we describe the framework application using the study by Breimaier, Halkens and Lohrmann (2015) that addressed the issue of translating evidence-based clinical practice guidelines by combining mixed methods with action research and community-based participatory approaches. The study aimed at identifying strategies for effective implementation of evidence-based guidelines for preventing falls among older patients in an acute hospital setting. The study was conducted in an Austrian teaching hospital and included nursing personnel from two hospital departments. Figure 4 provides the study abstract highlighting the research problem, methods, results, and conclusions.

Guided by the CFIR framework (Damschroder et al., 2009), six multifaceted implementation strategies were identified and tailored to the contextual needs of each hospital department using mixed methods and participatory action research approaches. The adaptation, implementation, and dissemination process involved all phases of the action research cycle, which is depicted in Figure 5. Mixed methods research was used throughout the process and informed the collection and analysis of data during the reconnaissance and evaluation phases of the study to generate meta-inferences by triangulating results from quantitative surveys, group discussions, and individual interviews with nurses. Each box in Figure 5 corresponds to a specific phase in the action research cycle and lists mixed methods procedures and mixed methods informed actions conducted during this phase. Solid arrows show the flow of the activities that were implemented in the study and reported in the article, whereas dashed arrows suggest further steps related to monitoring of the implemented clinical practice guidelines by conducting regular process evaluation and periodic educational sessions for nurses.

**Background:** Research- and/or evidence-based knowledge are not routinely adopted in healthcare and nursing practice. It is also unclear which implementation strategies are effective in nursing practice and what expenditures of time and money are required for the successful implementation of clinical practice guidelines (CPGs). The aim in this study was to assess the effectiveness and required time investment of multifaceted and tailored strategies for implementing an evidence-based fall-prevention guideline (Falls CPG) into nursing practice in an acute care hospital setting.

**Methods:** A before-and-after, mixed-method design was used within a participatory action research approach (PAR). The study was carried out in two departments of an Austrian university teaching hospital and included all graduate and assistant nurses. Data were collected through a questionnaire, group discussions and semi-structured interviews. Qualitative data were content-analyzed using a template based on the Consolidated Framework for Implementation Research (CFIR), which also served as a theoretical framework for the study. Quantitative data were descriptively analyzed using appropriate tests for independent groups.

**Results:** By applying multifaceted and tailored implementation strategies, the graduate and assistant nurses’ knowledge on fall prevention, how to access the Falls CPG and the guideline itself increased significantly between baseline and final assessment (p ≤ .001). Qualitative data also revealed an increase in participant awareness of fall prevention. A baseline positive attitude towards guidelines improved significantly towards the end of the project (p = .001). Required fall prevention equipment like baby monitors or one-way glide sheets were available for use and any required environmental adaptations, e.g., a handrail in the corridor, were made. Hospital nursing personnel (approximately 150) invested a total of 1,192 hours of working time over the course of the project.

**Conclusions:** Multifaceted strategies tailored to the specific setting within a PAR approach and guided by the CFIR enabled the effective implementation of a CPG into acute care nursing practice. Nursing managers now have sound knowledge of the time resources required for CPG implementation.

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Figure 4. Abstract of Breimaier, Halfens, and Lohrmann’s (2015) study.

Figure 5. Application of MMAR methodological framework for translational research to Breimaier et al.’s (2015) study. Note: MM = mixed methods; PAR = participatory action research.

During the diagnosing phase, the aims for the TR study were developed and framed in the participatory action research and mixed methods approaches. Information meetings with nurses at two hospital departments were conducted to communicate the study scope and aims and to engage nurses with the project implementation.
Steering groups were formed and included nurse representatives from both departments. During the reconnaissance phase, baseline quantitative and qualitative data were collected concurrently by surveying 106 nurses about their knowledge of and attitudes to fall-prevention clinical practice guidelines, as well as interviewing 18 nurses about potential influencing factors for successful guidelines implementation based on the CFIR framework. The results from the analysis of both survey and interview data informed the subsequent development (planning phase) and execution (acting phase) of educational sessions for nurses to raise their awareness of and enhance their use of the fall-prevention guidelines in their units. Six implementation strategies were identified that were adapted to specific purposes and needs of each unit within two departments. During the working-group sessions, nurses participated in compiling information folders that contained instructions for the guidelines implementation tailored to each unit.

The iterative evaluation process of the guidelines implementation included mixed methods data collection at two points—at mid-term and at the project completion—and focused on assessing the outcomes at two levels: nursing personnel and organization. Thus the evaluation phase was repeated twice, which is marked by the double-headed arrow between acting and evaluation phases in Figure 5. The same quantitative survey instrument was used and the same number of nurses were interviewed as in the reconnaissance phase to assess different aspects of the implementation process and to establish consistency in the evaluation of the implementation outcomes. The analysis of the quantitative and qualitative evaluation data provided evidence about the effectiveness of the tailored implementation strategies and a high potential for dissemination and sustainability of the adopted EBP. Quantitative analysis revealed increased positive attitude for following fall-prevention guidelines by nurses in the two departments. Individual interviews provided corroborating evidence by revealing facilitating and impeding factors as well as resources necessary for successful guidelines implementation. Further monitoring of this educational intervention is not discussed in the article; however, information folders prepared by nurses for each unit during education sessions and the dissemination of the study results to nursing managers suggest potential adoption and sustainability of the implemented clinical practice guidelines in the hospital departments.

In Breimaier et al.’s (2015) study, mixed methods was used to inform all phases in the action research cycle. During the reconnaissance phase, quantitative and qualitative data were collected and analyzed concurrently to assess nurses’ knowledge and attitudes to fall-prevention guidelines implementation and to explore potential facilitators and barriers both at the individual and organization levels. The results informed adaptation of implementation strategies and the content of education sessions. The process evaluation was conducted through a concurrent collection and analysis of quantitative and qualitative data using the same instruments. The integrated quantitative and qualitative findings helped obtain more rigorous conclusions about the implementation outcomes and outlined directions for further dissemination, implementation, and monitoring of the evidence-based generated practices.

**Concluding Thoughts**

In this article, we discussed the use of mixed methods in TR and described five interdisciplinary methodologies—EBP, adaptation, D&I, CBPR, and action research—that play an important role in the TR process. We showed how these methodologies interrelate with each other and jointly facilitate the translation of research findings into practice by shaping the methodological and decision-making processes during TR. The intersection of mixed methods research with each of these methodologies expands their scope and adds rigor to the assessment of the TR process and outcomes, providing a way of integrative thinking for addressing complex problems (Martin, 2007). Next, we introduced a MMAR methodological framework for TR and illustrated its application in nursing practice research. The advantage of the framework is that it integrates mixed methods research into each step of the community-based participatory action research process with the purpose of enhancing the processes of adaptation, dissemination, and implementation of EBP in professional and community settings. The framework captures the synergistic interplay among these methodologies at different stages in the TR process as informed and enhanced by mixed methods research, thereby providing a solid theoretical foundation for promoting sustainability of the knowledge translation process. The ability of mixed methods when combined with the community-based participatory action research to explore the issue at different levels from different perspectives makes the research findings extend beyond local knowledge and become more applicable in larger scientific and professional community settings. This makes mixed methods a viable methodological approach to inform and enhance TR, thereby bridging the gap between science and practice.
References


