

Advancements in Contemporary Physical Therapy Research: Use of Mixed Methods Designs

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The purpose of this article is to advocate for the use of mixed methods designs in contemporary physical therapist research. Mixed methods designs are used for collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies to both explain and explore specific research problems, thereby enriching the breadth and depth of understanding phenomena. These designs are particularly well suited for physical therapist researchers to reveal the complexity of disablement, rehabilitation, and recovery processes. Although contextual factors influence a person's health condition and recovery, they remain empirically less understood and underexplored by physical therapist researchers. To address this gap, the authors describe various combinations of quantitative and qualitative methods and data within a single study or set of related studies and the decisions that underlie the uses of these combinations. They include examples from current physical therapist research and applications from the *International Classification of Functioning, Disability and Health* (ICF) model. They argue that the rigorous application of quantitative and qualitative methods and data can propel physical therapist research and practice forward by stimulating new research questions, creating a holistic understanding of patient injury and rehabilitation, and contributing to innovative, complex treatment interventions.

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Mixed methods research designs have gained popularity in health care professions such as nursing, health services, and public health over the last few decades due to their utility in applied research, the high-quality inferences they yield, and the overall complexity they reveal.¹⁻³ Their strength also lies in their ability to cross-validate results and offset the limitations of using only one methodological approach. Physical therapy is a health care profession responsible for restoring function in patients who often present complex movement impairments that are influenced by ongoing personal and social factors. As such, mixed methods research provides physical therapists with opportunities to broaden their scope and depth of understanding patients' illness, injury, and rehabilitation.

In mixed methods designs, researchers use both quantitative and qualitative methods and data in combination in a single study or set of related studies.^{2,4-9} Although quantitative research is particularly effective for examining causal relationships among variables and making predictions, it often fails to illuminate the context within which these relationships occur and does not address questions of "how" and "why" particular relationships among variables exist. Qualitative methods can explore social and behavioral issues related to both illness and rehabilitation at a deeper level than quantitative methods allow,¹⁰⁻¹² such as understanding the meaning of pain, injury, and disease from the individuals' lived experiences and how these meanings differ across specific contexts.¹³⁻¹⁶ Although qualitative projects enable scholars to extend and refine theory, they include fewer cases than quantitative research, thereby minimizing generalizability of findings to larger populations.

Combining these methods, therefore, allows researchers to capitalize on the strengths of each. Standardized measures and secondary analyses can confirm hypotheses and predict rehabilitation participation and treatment outcomes,¹⁷ and an interpretive and naturalistic approach enables in-depth understandings of patients' experiences and the larger contexts that shape their injury, treatment, and rehabilitation.¹⁸ Mixed methods are especially well suited to studying the complex processes of disablement in the World Health Organization's *International Classification of Functioning, Disability and Health* (ICF),¹⁹ namely the dynamic relationships between physical and psychosocial contextual factors that influence recovery.²⁰ In turn, findings from these research designs promise to shape physical therapy treatment interventions.

Recent studies have illustrated that physical therapist researchers are indeed drawing on the strengths that mixing quantitative and qualitative methods offers, primarily by conducting interviews with a small subset of respondents after collecting survey data from a larger patient population.^{21,22} This type of mixed methods design—a Quantitative-qualitative design*—is but one of several ways to integrate various types of methods and data into physical therapist research.³ The purpose of this perspective article is to differentiate mixed methods design options and highlight the justifications that underlie them. We hope to encourage physical therapist researchers to examine and expand their options for mixed methods research in physical therapy by addressing the processes

* Capital letters are used to denote priority in research design maps to specify the researcher's intentions concerning which type of data has priority in a given study (ie, Quantitative-qualitative, Qualitative-quantitative, Quantitative-Quantitative) (Figure).

and procedures for choosing specific designs.

These designs imply that researchers have a wide range of methodological skill sets; yet, we acknowledge that being an "expert" in both quantitative and qualitative methods may be unrealistic. Although additional training in methodological research requires significant time (which often is in short supply), mixed methods designs present physical therapist researchers with opportunities for collaborative and interdisciplinary work to offset any limitations they may face regarding their own methodological training.

To address the aims of this article, we begin with a discussion of key factors to consider when conducting mixed methods research in terms of purpose, priority, sequencing, and integrating quantitative and qualitative methods and data. We then focus on 3 specific mixed methods designs: (1) *sequential explanatory*, in which quantitative methods are followed by qualitative methods; (2) *sequential exploratory*, a qualitative to quantitative design; and (3) *concurrent triangulation*, the simultaneous use of qualitative and quantitative methods to capture greater complexity in one study. We provide strategies to justify the choice of using a mixed methods design and include examples from current physical therapist research and applications from the ICF model to demonstrate their benefits.

Factors for Choosing a Mixed Methods Design Strategy

The key question has become not whether it is acceptable or legitimate to combine methods, but how they will be combined to be mutually supportive and how findings achieved through different methods will be integrated.^{23(p9)}

Choosing how best to integrate different methods to create a coherent analysis that yields a more in-depth understanding than might be gained from using one method remains at the center of mixed methods research. The challenge of combining methodological approaches (with fundamentally different philosophical underpinnings) that are mutually supportive and enrich our understanding of phenomena mandates that researchers create a systematic and theoretically meaningful plan to mix methods.³

Careful consideration and explicit articulation of a project's *purpose* constitutes the first step in deciding on a mixed methods plan. Next, researchers must make 3 key decisions before deciding which design strategy is most appropriate for a project: (1) the *priority* given to the quantitative and qualitative data and methods, (2) the *sequence of implementation* of methods for data collection, and (3) the phases in which the data and findings will be *integrated*. Underlying the choices regarding each of these factors is the aim of the overall project.

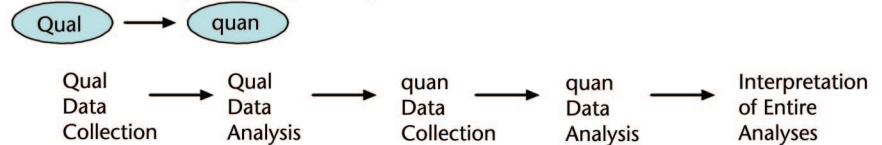
Purpose

As in all research, the first step in creating an appropriate mixed methods study design is that researchers must provide a clear statement regarding their research aims (see Creswell²⁴ for sample purpose scripts). Mixed methods designs are most appropriate when researchers have a specific issue or problem that is best understood through both explanation and exploration. These designs are equipped to simultaneously document large-scale patterns, isolate factors that influence outcomes, and identify causal relationships among variables while capturing detailed nuances of an issue based on focused observations of participants' lives and uncovering how participants experience and understand par-

Sequential Explanatory Design



Sequential Explanatory Design



Concurrent Triangulation Design

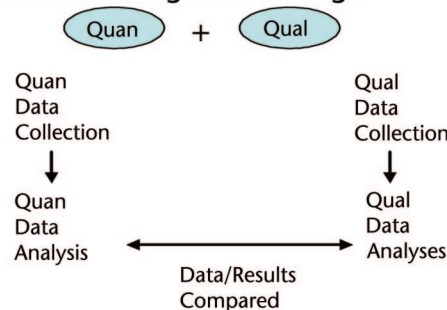


Figure.

Mixed methods designs. Quan=quantitative, qual=qualitative. Capital letters are used to denote priority in research design maps to specify the researcher's intentions concerning which type of data has priority in a given study (ie, Quan-qual, Qual-quan, Quan-Qual).

ticular phenomena.²⁵ Mixed methods designs require researchers to adopt a pragmatic stance toward valid knowledge claims so that they can collect and integrate different types of data through diverse methods by which to understand phenomena more comprehensively.^{6,17,25}

Some of the research questions in mixed methods studies are aimed at hypothesis testing and understanding patterns across and within large groups, which are best captured through quantitative methods.³ During this phase of mixed methods projects, researchers use deductive logic to test *a priori* hypotheses with reliable, closed-ended measures and statistical procedures that determine associations among variables. Data are controlled, isolated, mea-

sured, and tested to make predictions about specific, standardized outcomes. For these questions, health researchers draw from well-established methods such as experiments, quasi-experiments, correlational studies, and survey research.²⁶

Other research questions within the same study (or research program) aim for a deeper and naturalistic understanding of phenomena from the perspective of participants, constituting qualitative inquiries. Phenomenology, grounded theory, ethnography, realistic tales, case studies, and biographies enable researchers to study unexplored topics, generate and extend theories, and focus on the context in which phenomena are created, maintained, and changed.²⁷ These methods stress the social con-

struction of reality and the interactive processes through which meaning is created.¹⁴ Thick description occurs when researchers are close to participants, particularly through focused observations.²⁸ Data collection and analyses occur simultaneously in a systematic, iterative fashion, where each process mutually informs the other.²⁹

Researchers must specify the extent to which each of the study aims matters for the project, as they influence the next steps researchers take regarding the priority, sequence, and integration of the qualitative and quantitative methods and data. For example, the researchers' principal aim may be to study physical functioning and disability in patients who underwent total hip replacement. These researchers also may be interested in exploring racial and ethnic differences at a deeper level to discern how structural and cultural factors influence recovery processes related to patient-provider relationships. As we discuss below, these 2 particular aims best lend themselves to a mixed methods design that prioritizes quantitative data and sequences it before the qualitative data collection (quantitative-qualitative design), combining the 2 forms of data in the results phase.³

Priority

Once a researcher decides that a mixed methods design is appropriate to address the purposes of the study, the focus turns to the priority of the data and methods such that it is congruent with the research aims. Priority concerns the emphasis that researchers give to the collection, analysis, and interpretation of the quantitative or qualitative data.¹⁻³ Some studies place greater emphasis on quantitative methods and data, other studies place greater emphasis on qualitative methods and data, and some studies prioritize both equally.

To reiterate, the aim of a project guides decisions about the emphasis placed on the different types of data in a project. That is, if a study's primary aim is discovery, exploration, or thick description and meaning, the qualitative component of the study takes priority. In contrast, if the research aim centers on testing hypotheses or generalizing findings to larger populations, priority is given to the quantitative component of the project. A project that emphasizes the contributions of both deductive hypothesis testing (explaining) and inductive discovery (exploring) will give equal priority to both components.³

Camp et al²¹ offers one example from the physical therapy literature of a study that prioritizes quantitative data using a mixed methods design. Their study sought to assess the impact of a structured pulmonary rehabilitation program on physical and quality-of-life changes in 150 patients with chronic obstructive pulmonary disease. In this study, Camp et al created a close-ended survey comprising standardized outcome measures, including the Chronic Respiratory Questionnaire, the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), and spirometry. Following the survey, they conducted semistructured interviews to explore the personal experiences of 7 patients in the pulmonary program.

Camp et al²¹ prioritized the quantitative survey data because their primary aim was to demonstrate the effectiveness and generalizability of their structured pulmonary program. They used the interview data to explore participants' perceptions of the intervention program and to address a second aim of their study, which was to understand how patients attributed their changes in physical functioning and quality of life to this particular program. Thus, Camp and colleagues used the in-depth qualitative data to interpret *how*

and *why* specific patterns of changes occurred during the course of the program according to their patients. That is, the qualitative data collected after the survey data helped identify mechanisms that contributed to the quantitative findings they emphasized.

Currently, most physical therapist researchers often prioritize quantitative data and methods by testing hypotheses related to the physical domains of body functioning, physical impairments, and the extent to which patients can participate in different activities or are restricted from doing so.^{22,30} However, questions that are related to perceptual and structural domains within the ICF model (or questions derived from the researcher's clinical practice) lend themselves to qualitative research, thus providing physical therapist researchers a theoretical platform on which to prioritize qualitative data and methods.

More specifically, qualitative methods allow insight into social and economic contexts that often are not revealed through standardized quantitative measures. Consider, for instance, the following hypothetical example. Some patient profiles may suggest that the process of recovery from a minor injury will be relatively smooth and adherence to treatment plans will be high. Such profiles show that patients are young, have stable employment complete with health insurance coverage, are married with children, report low depression scores on the Beck Depression Inventory, and have personal transportation for appointments. Moreover, notes from patient files convey patients' genuine desire to heal quickly. Previous quantitative research provides robust evidence that these psychosocial variables positively affect recovery. However, clinical practice and recent research reports may document a growing trend among this group that shows the opposite—adherence to treatment plans is low

and recovery is slow among a group of patients where it should be high.

This anomaly provides researchers an opportunity to identify the personal and environmental factors shaping this group of patients' health conditions. Thus, the study aims to "dig" beneath the surface of standardized patient profiles and explore why this trend exists. Qualitative interviewing methods complement this aim in that they allow researchers to ask patients open-ended questions about their lives. The interview data may reveal that women have little time to devote to exercising outside of their physical therapy sessions, given responsibilities to job and family. We may learn that many of the women interviewed are part of the "sandwich generation," caring not only for her children but also for aging family members who can no longer live independently. Thus, findings may reveal significant constraints on women's own time. Despite a desire to follow the prescriptions of their providers, some of these women are unable to take time off from work for routine appointments, given how short-staffed their offices are. By probing deeper, we may learn that women are grateful to have a job, given the tight labor market in their communities, and cannot afford to lose it, given the rising interest rates on home mortgages. Thus, these interviews and patient narratives can reveal how the demands of everyday life and social relationships deterred those patients from adhering to treatment.

By prioritizing qualitative methods, researchers gain a more in-depth understanding of people's lives and empirically reveal the paths through which social and economic factors shape health conditions as posited in the ICF model. Unlike quantitative measures, qualitative depth is achieved through a smaller sample of patients, and findings are not

generalizable to larger populations.³¹ By following this qualitative phase with quantitative methods and a larger patient sample (a Qualitative-quantitative design), researchers can identify the frequency and extent to which these pressures affect their patients more broadly.

Implementation

Implementation refers to the sequence of data collection (sequentially or concurrently) in a particular study. Again, the project aim directs the sequencing choice for the order of particular method procedures. Researchers use a sequential process when one phase contributes to or clarifies another phase.³

The ICF framework illustrates dynamic and reciprocal pathways through which physical, contextual, and personal factors influence illness (and rehabilitation) experiences and health outcomes.²⁰ Following theoretical logic of the ICF, researchers may choose to perform in-depth interviews in a specific patient population to help formulate items for a questionnaire to use in a larger-scale study, creating a qualitative-quantitative sequence.

A study by Mancuso et al³² provides an excellent example of how qualitative data collection and analyses can help develop quantitative measures. In this project, participants were asked open-ended questions about their expectations for surgery and the importance of each expectation prior to their surgeries. Specifically, the authors used qualitative interviews in the first phase of developing a patient-derived knee expectations survey after knee surgeries. Patients were asked, "What are your expectations of the surgery you are going to have for your knee?" and "How important is each expectation?"

A sample of 377 patients[†] completed these interviews, and Mancuso et al³² identified a total of 1,161 expectations. Analyses revealed that expectations varied by patient characteristics: younger patients were more concerned about improvements in sports performances and for the knee to be "back the way it was" before symptoms started. In contrast, older patients were more likely to prioritize pain relief and improved walking ability. Patients with less education were more likely to expect psychological improvement and pain relief; whereas patients with more education were more likely to desire improvement in sports performance.

Mancuso et al³² transformed these data into categories of patient expectations and developed a valid and reliable questionnaire to use preoperatively to direct patient education, share decision making, and provide a framework for setting reasonable goals. Specifically, the authors generated a 17-item survey for patients undergoing total knee replacement and a 21-item survey for patients undergoing other types of knee surgeries. Therefore, the qualitative data provided the basis for a patient-derived template used by orthopedic surgeons to guide discussions about patient goals based on age, educational level, and types of surgery.

As stated above, many physical therapist researchers conduct mixed methods research using a quantitative-qualitative sequence, whereby textual or narrative data clarify and expand on statistical findings from a larger population. Pizzari et al²² conducted this type of mixed methods sequence by selecting 11 patients with anterior cruciate ligament (ACL) reconstruc-

[†] This constitutes a large data set for qualitative research. Such a sample size is possible, given that these researchers included 2 open-ended questions rather than use a qualitative method such as grounded theory or ethnography.

tions for a qualitative study using interviews at an average of 4.8 months into a rehabilitation process. They selected participants from a larger quantitative research project analyzing the adherence-outcome relationship in ACL rehabilitation. In the larger study, adherence was measured through scores of attendance at physical therapy appointments, therapist ratings of patient adherence during appointments, and self-reported adherence to home-exercise programs. Based on these quantitative data, the authors stratified patients into 2 groups (patients who were adherent and patients who were nonadherent, particularly with respect to their home programs).

The subsequent interviews occurred with a small sample of both patient groups to provide a greater understanding of contextual factors that influence rehabilitation, namely psychological states and environmental constraints. Significant psychological factors included self-motivation, maintaining interest in rehabilitation, and fear of physical reinjury. The respondents who were adherent told stories that reflected greater self-direction and interest in and enjoyment of rehabilitation, whereas the nonadherent participants used phrases such as “boring more than anything” to describe their home exercises. Patients who were nonadherent consistently spoke about their fear associated with return to sport and talked about delaying the return to sport despite assurances from their physical therapists. Patients who were nonadherent also discussed environmental factors that shaped their home program, such as the extended length of the rehabilitation process, isolation of the program, lack of perceived effectiveness of the exercises, and lack of equipment.

In combination, the quantitative-qualitative sequence enabled Pizzari et al²² to first classify selected pa-

tients from a large patient population as adherent or nonadherent to rehabilitation. Follow-up interviews then allowed the authors the advantage to more fully learn about patients’ experiences of ACL injury and to identify emotional influences (eg, fear) and psychosocial needs (eg, emotional support) that shaped completion of their rehabilitation. The findings gleaned from the qualitative work are key to patients’ successful rehabilitation. Sequencing the quantitative methods and data first does not imply that researchers place priority or emphasis on them. Rather, the methods and data work together to provide a more comprehensive understanding of the needs of patients with ACL injuries.

These examples show how physical therapist researchers incorporate open-ended questions and interviews into their study designs. This form of data collection reflects the predominant way that rehabilitation researchers, to date, use qualitative methods in mixed methods designs. Open-ended questions, however, are not inherently grounded in qualitative methods. They also do not reflect the range and depth of interpretive methods that prioritize meaning, subjectivities, context, and depth. In fact, there is a wide range of methods associated with qualitative research that are each grounded in their own procedures and processes for collecting and analyzing data.

Researchers who routinely draw from these qualitative methods are highly trained and skilled in the theoretical underpinnings, application, and methods for analyses. Grounded theory,²⁹ ethnography,²⁸ narrative research,³³ and phenomenology^{12,34,35} provide physical therapist researchers with various options to study qualitative research questions. Data from different sources, such as clinical observations, health policy documents, pa-

tient diaries, and focus group interviews, can be collected and analyzed in addition to individual interviews. Analyzing these data qualitatively enables a much deeper understanding of phenomena than a few open-ended questions allow. Collaborating with qualitative researchers in the health and social sciences, thus, becomes particularly appealing to physical therapist researchers who want to use mixed methods but are not trained in the breadth of qualitative methods.

Integration

Integration remains one of the most important factors to consider in mixed methods research. The integration of data is the point or points in the project where the researcher combines the 2 types of data.³ This can occur during the data collection, analyses, or interpretation and results phases, or at a combination of points. That is, questions of where, when, and how data will be combined in meaningful ways remain central to mixed methods research. The justification for integration is to provide internal coherence to the results for a more complex and complete analysis.

Integration can be a daunting process for researchers using mixed methods. Bryman³⁶ conducted interviews with a number of mixed methods researchers and found a tendency toward *non-integration* in several studies. These studies reported either quantitative or qualitative data or gave more attention to only one type of data. Researchers identified several barriers to integration, including a tendency to think of qualitative and quantitative research as discrete domains that inhibit mixed methods altogether, the nature of the audience (ie, basic scientists, traditional health researchers, and clinicians who are more comfortable with quantitative measures and outcomes), and the methodological training of the researchers.

Woolhead et al³⁰ provide an example of successful integration from physical therapist research. In their study of patients after knee surgery (including total hip replacement), they integrated qualitative and quantitative questions during data collection and then drew from both sets of data during the results phase. More specifically, they purposively sampled 10 patients across demographic characteristics and conducted interviews with them 6 months after their surgeries. During semistructured interview sessions centered on their postsurgical experiences, patients also rated their operation outcomes along a Likert scale as excellent (2), very good (3), or good (4). Although the majority of the patients (n=9) stated that their total hip replacement operation was good to excellent, the interview data showed that almost all of the patients (n=8) indicated they still experienced continued pain and immobility.

The qualitative data also help us understand this anomaly by showing that patients' perceptions of functional outcomes were closely related to quality-of-life issues including their community and personal faith. For example, 1 patient, although in as much pain after the operation as before the operation, stated that she had a good outcome because her recovery process coincided with her move from a lonely neighborhood to a more community-spirited neighborhood. Other patients made sense of their pain and immobility within their religious beliefs, stating that their pain was "God's way of trying to make them a better person." Thus, in this study, the authors' simultaneous use of both qualitative data and quantitative data illuminated the ways that people make sense of their illness experience and outcomes in relation to current life issues.

Mixed Methods Designs

Although there is a good deal of flexibility in "mixing" the key factors discussed above into various designs, we elaborate on 3 specific designs that are particularly salient for physical therapist research. Experts in mixed methods (eg, Creswell and colleagues,^{3,5,24} Tashakkori and colleagues^{1,2,17}) have provided templates of these designs for novice or less-experienced mixed methods researchers and have advocated the use of maps to represent these designs in research proposals, articles, and reports. These maps visually demonstrate the specific ways in which researchers choose to combine and integrate qualitative and quantitative methods, which can be especially helpful for grant reviewers and funding agencies (Figure).

Sequential Explanatory

A sequential explanatory design is perhaps the most straightforward and common mixed methods design in health studies. As such, it may best resonate with the current climate of physical therapist research. Following the norms of medical and health research, the purpose of this design is to explain phenomena and confirm hypotheses using standardized (and, therefore, comparable) measures with relatively large samples. Thus, in a sequential explanatory design, priority is given to the quantitative data. Both Camp et al²¹ and Pizzari et al²² used a sequential explanatory design. Accordingly, both research groups gave priority to the quantitative research; they collected and analyzed their quantitative data first through survey methods. Camp et al collected standardized outcomes related to their pulmonary intervention program, whereas Pizzari et al quantitatively measured scores of physical therapy attendance. Both studies also followed this phase with qualitative data collection and analyses and incorporated the results of these inquiries to bolster and expand

the main quantitative findings. Therefore, the integration of quantitative data with qualitative data occurred during the interpretation and results stage. Qualitative findings complemented the quantitative findings and generally helped interpret the findings from the quantitative component of the project. These 2 examples show how following quantitative methods with qualitative methods allows researchers to expand upon patients' experiences that were initially assessed using closed-ended measures. This type of sequential design can help ensure construct validity and explore additional contextual variables that affect patients' experience scale scores.

A sequential explanatory design also is useful in when quantitative findings yield unexpected results that require further elaboration. For instance, researchers may conduct observations or interviews to explore anomalies, outliers, or nonstatistically significant findings from a survey or experiment. Theoretically, domains and relationships among them in the ICF can help researchers think about factors that contributed to the unanticipated findings in their quantitative analyses. As noted earlier, this model is particularly useful for thinking through underexplored interactions with contextual variables or for exploring the presence of outliers in large-scale quantitative samples. A weakness associated with a sequential explanatory design is the time it requires to conduct 2 separate phases of data collection and analyses and then integrate numerical and thematic or textual data into a coherent whole (Figure).

Sequential Exploratory

A sequential exploratory design structurally resembles the sequential explanatory design. That is, data collection and analyses occur in 2 distinct phases, one following the other, with data integration occurring at the interpretation and results phase. The

purpose of research that uses a sequential exploratory design differs, however, in that such studies focus on discovery rather than explanation or confirmation. Thus, priority is given to the qualitative data, and qualitative data collection and thematic analysis precede quantitative data collection and analyses.³

Sequential exploratory designs provide the opportunity for researchers to begin with a broad focus and refine it over the course of the study. Indeed, by inverting the common Quantitative-qualitative sequence, new foci are possible. Interviews and systematic observations can lead to new, patient-driven research questions that can be followed with quantitative methods.

This type of mixed methods design also is helpful when researchers are developing a new instrument, as illustrated in the study by Mancuso et al.³² Their open-ended interviews with patients prior to surgery laid the foundation for the development of a reliable and valid survey of patient expectations about surgical outcomes. Their priority on exploration (thus privileging the qualitative component of their design) fits with the study's aim on patient expectations, which are inextricably linked to meaning and subjectivity that cannot be captured through closed-ended questions.

Focus groups provide another qualitative method through which patients can identify issues to be later assessed in a survey with a larger sample to test reliability and validity of the emerging patient-centered items affecting their disability experiences, rehabilitation, and recovery. In some cases, focus groups generate conversations among patient participants in ways that lead to more information than one-on-one interviewing.

Additionally, researchers can probe major environmental issues within the ICF model, such as access to health care, in ways that expand current standardized measures. Access to care remains important to the majority of patients, yet manifests differently across various contexts. Patients living in a densely populated urban area may experience chronic strains related to difficult-to-navigate public transportation (eg, congested subways and buses, schedules), which may affect their access to clinics and ability to keep rehabilitation appointments. Rural residents also may experience difficulty with access to clinics, but it may be due to the geographic distance they must travel to urban or suburban centers for routine appointments. Both situations speak to the built structural environments in which people live, but each would require different tactics for addressing their limitations in accessing care. If various types of access to care surface during focus groups, then each of the particular types can be included as response categories in a survey instrument distributed to larger groups of patients. The weakness of this design again relates to the extensive time it takes to conduct 2 distinct phases of data collection and analyses.

Concurrent Triangulation

Researchers use a concurrent triangulation design when they want to explain phenomena and explore process-related dynamics at the same time. From the outset, a project using this design begins with research questions that are both deductive and inductive. Thus, *concurrent triangulation* refers to the simultaneous collection and analyses of both qualitative and quantitative data. Ideally, priority is given to both types of data, and integration can occur at different levels. The strength of this design is its potential for capturing the immediacy of the qualitative and quantitative processes of disability experiences or for

gaining a complex understanding of quantitative measures. For instance, a researcher can incorporate significant open-ended questions in a structured survey instrument so that both qualitative and quantitative data are collected in the same instrument. Alternately, a structured survey instrument with standardized measures can be distributed to a larger sample while focus groups are simultaneously conducted with smaller subsamples of the larger population to explore questions that are not easily quantifiable. In this type of design, the justification for collecting and analyzing 2 distinct types of data centers on the way each can offset the limitations of the other, and their combination allows researchers to ask “what,” “how,” and “why” questions at the same time.

Concurrent designs can capture the complexity of multiple factors presented in the ICF model and help create the process paths through which they operate in a study. For instance, quantitative methods and data may be best suited to isolate and identify the most-effective interventions that address changes in body functions and structures (impairments) related to outcomes in activities (function) or participation (disabilities) in patients with frozen shoulders or rotator cuff injuries. Standardized physical therapy outcome measures that are quantifiable might best identify the extent of the injury, predict outcomes, or investigate the degree to which specific treatment interventions facilitate healing or functional outcomes (physical therapy versus surgery), the time it takes for recovery, and how different treatment options affect other types of body functioning, such as blood pressure, cardiovascular strength, and the like.

Qualitative methods can probe the meaning of the injury to a patient and the patient's values related to particular outcomes, frustrations of

rehabilitation, and concerns related to function. Understanding both body functioning and the patient's perspectives about functioning can inform physical therapists about psychosocial elements of recovery that perhaps require modifications of current strategies and progression of rehabilitation. A weakness of a concurrent triangulation design is that researchers must be trained in both types of research.

Conclusion

The purposes of this article were to describe several mixed methods designs and to illustrate how these designs apply to different physical therapist research purposes and study aims. In general, studies that seek to explain and explore phenomena are particularly amenable to designs that combine quantitative and qualitative methods. We advocate that these designs offer physical therapists a tool to stimulate new research questions, create a holistic understanding of patient injury and rehabilitation, and contribute to innovative, complex treatment interventions. More specifically, we suggest that the complexity of the disablement experience in the current ICF model is better understood through the examination and exploration of the interactions of physical, personal, and environmental factors through mixed methods. Moreover, this research approach can foster relationships between physical therapists and researchers in other disciplines, expanding collaborations that we believe are consistent with nationally funded research endeavors.

The 3 mixed methods models presented—sequential explanatory, sequential exploratory, and concurrent triangulation—provide physical therapist researchers with options for mixing methods. The choice for which design is most suitable rests with the original purposes or aims of the study. Based on the research aim, research-

ers then make decisions about the priority of data and methods, the ways in which different methods are sequenced in a study or research program, and how quantitative and qualitative data will be integrated.

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References

- 1 Tashakkori A, Teddlie C, eds. *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: Sage; 2003.
- 2 Tashakkori A, Creswell J. The new era of mixed methods. *Journal of Mixed Methods Research*. 2007;1(1):3-8.
- 3 Creswell J, Plano V. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage; 2007.
- 4 Tashakkori A, Teddlie C. *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Thousand Oaks, CA: Sage; 1998.
- 5 Creswell J, Fetters MD, Ivankova NV. Designing a mixed methods study in primary care. *Ann Fam Med*. 2004;2:7-12.
- 6 Onweugbuzie AJ, Leech NL. On becoming a pragmatic researcher: the importance of combining quantitative and qualitative research methodologies. *International Journal Social Research Methodology*. 2005;8:375-387.
- 7 Sale JEM, Lohfeld LH, Brazil K. Revisiting the quantitative-qualitative debate: implications for mixed-methods research. *Quality and Quantity*. 2002;36:43-53.
- 8 Morse J. Principles of mixed methods and multimethod research design. In: Tashakkori A, Teddlie C, eds. *Handbook of Mixed Methods Social and Behavioral Research*. Thousand Oaks, CA: Sage; 2003.
- 9 Johnson RB, Onweugbuzie AJ. Mixed methods research: a research paradigm whose time has come. *Educational Researcher*. 2004;33(7):14-26.
- 10 Patton MQ. *Qualitative Evaluation and Research Methods*. 2nd ed. Thousand Oaks, CA: Sage; 1990.
- 11 Shepard K, Jensen GM, Schmoll BJ, et al. Alternate Approaches to research in physical therapy: positivism and phenomenology. *Phys Ther*. 1993;73:34-43.
- 12 Jensen GM. Qualitative methods in physical therapy research: a form of disciplined inquiry. *Phys Ther*. 1989;69:492-500.
- 13 Dudgeon B, Gerrard BC, Jensen M, et al. Physical disability and the experience of chronic pain. *Arch Phys Med Rehabil*. 2002;83:229-235.
- 14 Denzin NK, Lincoln YS, eds. *Collecting and Interpreting Qualitative Methods*. Thousand Oaks, CA: Sage; 1998.
- 15 Eurenium E, Biguet G, Christina H. Attitudes toward physical activity among people with rheumatoid arthritis. *Physiother Theory Pract*. 2003;19:53-62.
- 16 Maclean N, Pandora P, Wolfe C, Rudd A. Qualitative analysis of stroke patients' motivation for rehabilitation. *Br Med J*. 2000;321:1054-1054.
- 17 Tashakkori A, Creswell J. Exploring the nature of research questions in mixed methods research. *Journal of Mixed Methods Research*. 2007;1:207-211.
- 18 Huston P, Rowan M. Qualitative studies: their role in medical research. *Can Fam Physician*. 1998;44:2453-2458.
- 19 *International Classification of Functioning, Disability and Health: ICF*. Geneva, Switzerland: World Health Organization; 2001.
- 20 Jette AM. Toward a common language for function, disability, and health. *Phys Ther*. 2006;86:726-734.
- 21 Camp G, Appleton J, Reid WD. Quality of life after pulmonary rehabilitation: assessing change using quantitative and qualitative methods. *Phys Ther*. 2000;80:986-995.
- 22 Pizzari T, McBurney H, Taylor N, Feller J. Adherence to anterior cruciate ligament rehabilitation: a qualitative analysis. *J Sports Rehabil*. 2002;11:90-102.
- 23 Office of Behavioral and Social Science Research. *Qualitative Methods in Health Research: Opportunities and Considerations in Application and Review*. Bethesda, MD: National Institutes of Health; 1999.
- 24 Creswell J. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 2nd ed. Thousand Oaks, CA: Sage; 2004.
- 25 Morgan DL. Paradigms lost and pragmatism regained: methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*. 2007;1(1):48-76.
- 26 Campbell D, Stanley JC. *Experimental and Quasi-Experimental Designs for Research*. Boston, MA: Houghton Mifflin Co; 1963.
- 27 Creswell J. *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*. Thousand Oaks, CA: Sage; 1998.

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- 28 Geertz P. *The Interpretation of Cultures*. New York, NY: Basic Books; 1973.
- 29 Strauss A, Corbin J. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd ed. Thousand Oaks, CA: Sage; 1998.
- 30 Woolhead G, Donovan J, Deippe P. Outcomes of total knee replacement: a qualitative study. *Rheumatology (Oxford)*. 2005;44:1032-1037.
- 31 Lincoln Y, Guba E. *Naturalistic Inquiry*. Thousand Oaks, CA: Sage; 1985.
- 32 Mancuso C, Sculco TP, Wickiewicz TL, et al. Patients' expectations of knee surgery. *J Bone Joint Surg Am*. 2001;83:1005-1012.
- 33 Sparkes AC. *Telling Tales in Sport and Physical Activity: A Qualitative Journey*. Champaign, IL: Human Kinetics Inc; 2002.
- 34 Moustakas C. *Phenomenological Research Methods*. Thousand Oaks, CA: Sage; 1994.
- 35 Benner P. The tradition and skill of interpretative phenomenology in studying health, illness, and caring practices. In: Benner P, ed. *Interpretive Phenomenology: Embodiment, Caring, and Ethics in Health and Illness*. Thousand Oaks, CA: Sage; 1994:99-127.
- 36 Bryman A. Barriers to integrating quantitative and qualitative research. *Journal of Mixed Methods Research*. 2007;1(1):8-22.