PERSPECTIVES

Multimethod Research:

Approaches for Integrating Qualitative and Quantitative Methods

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IN APPROACHING their inquiry, researchers in medicine and most of the behavioral sciences have commonly employed quantitative methods. However, in recent years there has been renewed interest in qualitative research as an additional methodologic approach.[1–3] The quantitative approach uses techniques from biostatistics and epidemiology to determine the association between independent and dependent variables. Qualitative approaches, on the other hand, use case and field study designs common to the ethnographic tradition in anthropology and education, and to the qualitative traditions in sociology and psychology (see Tesch[4] and Miller and Crabtree[5] for an overview).

Quantitative and qualitative approaches differ in research design and in data collection and analysis techniques. *Quantitative research* traditions typically emphasize a hypothesis-testing approach. A-priori hypotheses are tested, and if not disproved, the argument for them is strengthened. The specification of a quantitative study design usually implies a fairly standard approach to the sampling, collection, statistical analysis, and presentation of data. Data collection techniques in qualitative research strive for reliable measurement of predefined concepts. If the measurement techniques are accurate, meaningful, and relevant to the study subjects, and if appropriate probability sampling techniques are used, quantitative data have the advantage of generalizability to other similar researchers and settings.

Qualitative research designs are typically interpretive.[5] Observations or interviews are used to generate descriptions, themes, concepts, taxonomies, typologies, postulates, portraits, or theories. These are each refined, verified, or rejected in a continuous data collection and analysis feedback spiral toward greater abstraction. Because of this interpretive nature, it is more difficult to specify a priori the approach to be taken when a qualitative study design is used. The researcher creates a design, integrating techniques according to the emerging goals of the study. Data collection techniques used in the qualitative approach are typically open-ended and iterative. They yield rich and ecologically valid descriptive data that uncover patterns and connections. These techniques include collecting in-depth data, usually in the form of participant observation, focus groups, or depth interviews, with a small group of study subjects in order to glean domains of culturally relevant meaning. Analytic strategies are interpretive in nature.

Both qualitative and quantitative approaches have rich traditions. Researchers are typically trained in either one or the other paradigm and methodology. Journals, with rare exceptions, have tended to publish either quantitative or qualitative research, but seldom both. A lack of understanding of alternative research approaches and a philosophical belief in the fundamental differences between the two approaches[6, 7] have tended to polarize quantitatively and qualitatively oriented researchers into two camps.[8]

Despite this debate, there is increasing interest in integrated multimethod approaches to research.[1, 3, 7] "The multimethod approach is a strategy for overcoming each method's weaknesses and limitations by deliberately combining different types of methods within the same investigation."[9] Most research endeavors can be enhanced by including some features of other approaches as a means of cross-validation or triangulation. Expressing research questions so that they always fit one paradigm or another is limiting. In the dynamic research process, the level of understanding is constantly evolving, and the research questions change as understanding unfolds.

The progression of a research idea from identification toward quantifying, verifying, and generalizing observations and hypotheses leads the researcher toward quantitative data collection techniques. Yet, this journey takes the researcher farther away from the phenomenon. In the process of ensuring reliability and gen-

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eralizability, the researcher may miss much of the valid and meaningful information. The integrated use of both qualitative and quantitative approaches can allow for an understanding of meaning, along with quantitative testing of hypotheses. We propose that a combination of the two approaches can yield higher-quality results without unreasonable additional effort, and can be a more efficient and encompassing way to create understanding.

A MULTIMETHOD APPROACH

Integrated research approaches can use quantitative and qualitative techniques either sequentially or concurrently. Qualitative methods may be used in advance of a quantitative study to develop hypotheses and validate measures. Alternatively, qualitative methods may follow a quantitative study to explain the meaning of findings. Both methods may be used concurrently either in parallel or in truly integrated multimethod research designs.

In the examples that follow, we first present a case in which quantitative methods generated a new study question and provided a quantitative sampling frame for subsequent qualitative research. The second example describes a research study designed to include the simultaneous use of qualitative and quantitative data collection techniques. In this example, the qualitative data were used to explain or amplify the meaning of findings from the quantitative study, to cross-validate the findings and measurement techniques, and to generate new hypotheses.

The final example depicts a more complex, integrated multimethod approach. In this case, the research question was developed through multiple levels of inquiry: identification, description, association, and prediction (see Miller and Crabtree[5]). Different methods were used at each level to maximize validity and relevance.

CASE EXAMPLES

Example 1: Sequential Use of a Multimethod Approach

For several years researchers at the University of Connecticut have been using quantitative methods to examine the effect of the organization of health care services and psychosocial factors on variation in metabolic control of people with non–insulin-dependent diabetes mellitus.[10–13] The most recent epidemiologic investigation prospectively evaluated the impact of an educational intervention on glycemic control.[13] An unexpected finding was that while patients with recently diagnosed diabetes improved their metabolic control while attending the diabetes care program, patients who had diabetes for longer than two years tended to demonstrate no change. This association was explained neither by biomedical data, including measures of diabetes complications, nor by psychosocial measures of family function, social support, and locus of control.

The epidemiologic results, despite reaching an impasse with known concepts and measures, did provide an exciting starting point for further study. It was apparent that factors that had not been identified, defined, or refined into a quantitative measure differentially affected these groups. Several members of the research team are well-versed in qualitative and quantitative research methods. As a way to explain the unanticipated results, inductive, meaning-centered qualitative research was designed to explore and identify factors that showed how diabetes and its chronicity affect people's lives, thus increasing understanding of the association discovered using quantitative methods.

For the qualitative research, people were classified into four distinct groups based on long or short duration of diabetes and degree of metabolic control. Focus groups were used to discover concepts that were salient to and that differentiated these four groups. Focus group data were supplemented with in-depth interviews. The focus groups were tape-recorded and transcribed using the approach described by Morgan.[14] The transcripts of both the focus groups and the in-depth interviews were analyzed using an adaptation of the grounded theory approach of Glaser and Strauss,[15] as modified by Crabtree and Miller.[16] The purpose of the analysis was to identify themes, concepts, and patterns that distinguish the four groups.

Among the intriguing findings,[17] it was found that patients who successfully responded to the program described an epiphany, that is, a "turning point" that made them decide to take diabetes seriously and to integrate it into their lives. In some cases, it was seeing a close friend or relative having devastating outcomes from diabetes; in others, the epiphany was exposure to an inspirational person who had successfully learned to live with diabetes. This epiphany was never described as being related to the health care system or health care providers. In fact, a number of respondents reported they changed their primary physician when that physician did not also begin to take their diabetes more seriously.

This example illustrates how qualitative and quantitative methods can be used sequentially. The survey research component served to focus the research question and to suggest an initial sampling frame, while results from the qualitative component enabled the researchers to better understand the statistical results. In addition, the qualitative findings provided a better theoretical understanding of the meaning of diabetes in people's lives. A follow-up quantitative study is now warranted with new and better measures, and an intervention program that seeks to facilitate their epiphanies is being planned. In contrast with being left with a puzzling quantitative finding that was difficult to interpret, the

post-hoc use of qualitative methods to explore patient experiences yielded a pattern that both explained the findings and led to new hypotheses.

Example 2: Concurrent Use of a Multimethod Approach

Work-site health promotion programs, while beneficial to the majority of participants, enroll only a minority of employees at most work sites. In an effort to identify potentially mutable factors associated with participation, a prospective study was planned using both qualitative and quantitative methods at a work site embarking upon a new health promotion program. Baseline quantitative data were gathered for employees, using a questionnaire measuring factors that the literature suggested might be associated with participation. The program was then offered to all employees, and employee scores on the baseline measures were compared for those who enrolled and those who did not. Among the multiple measures of psychosocial factors, only perception of program efficacy was associated with participation. Social support was associated with participation only in subgroup analysis of nonwhite employees.[18]

Initially, it had been proposed that the study findings be used to design interventions to increase participation; however, the largely null findings gave little insight into how such interventions might be focused. In addition, the quantitative data were of little use in deciphering the meaning of the null findings. Fortunately, the collection of qualitative data had been integrated into the study design, and was helpful for these purposes.

As part of the planned research design, additional semistructured interviews were given to employees after they had chosen to participate or not. A 5% random subsample of those who chose to participate and a 5% random subsample of those who chose not to participate were selected for the interview. Analysis and rank ordering of the frequency of responses to questions about why people participated or not or what would have made them more likely to participate, gave insights that will be more directly helpful than the survey data in designing interventions to increase participation.[19]

In addition, open-ended key informant interviews were conducted at the work site before, during, and after the program was announced. The key informants included the occupational health nurse, the medical director, and the director of human resources. Analysis of these interviews revealed that initial interest in the health promotion program came predominantly from employees already committed to fitness and health. However, as these employees began talking about the program with their coworkers, a much wider cross-section of employees began enrolling, including employees with initially negative attitudes toward health and fitness and those with poor health habits.[19]

Interview interpretation led to the conclusion that social network factors and changes in the work culture may be more important than preexisting attitudes and beliefs in determining participation. Key informant data also pointed out that the survey methodology was flawed for determining the effect of psychosocial factors on the decision to participate. As part of the prospective epidemiologic study design, the psychosocial variables had been measured prior to the enrollment period to allow their assessment independent of any effect of program participation on attitudes and beliefs. However, the process of introducing the health promotion program apparently altered these attitudes and beliefs, making the initial measures less relevant to the individual's decision about participation.

In this primarily quantitative epidemiologic study, key informant and semistructured interview data collections were included concurrently with a small amount of additional effort and cost. The insights provided by these qualitative data were useful in discerning methodologic reasons for the largely null findings, in interpreting the meaning of the findings, and in designing future studies and applied interventions.

Example 3: A Multimethod Approach to a Total Research Package

Example 1 illustrated the simple sequential use of qualitative and quantitative methods, and example 2 described the simple concurrent integration of these methods. The third example moves beyond this dichotomous understanding to a more integrated, multimethod approach to a particular trajectory of research. In this example, multiple data collection and analysis strategies were used in an effort to maximize the validity, relevancy, and generalizability of the research.

A recently published study of hip fracture among independently living elderly subjects[20,21] sought to understand the experience of hip fracture and to determine the psychosocial predictors of successful return to function.

This research proceeded through multiple stages. Standard epidemiologic approaches were taken to recruit a sample of 80 subjects with uncomplicated fractures who met inclusion criteria for function and independent living. Data were collected using a combination of methods. Formal scales measured functional status, social function, psychological well-being, and sickness behavior. In-depth tape-recorded ethnographic interviews with the subjects were used to gather data defining the important domains of the experience of having a hip fractured. In addition, participant observation on the orthopedic floors gathered both confirmatory and exploratory data describing the injury and rehabilitation processes. The quantitative data permitted generalization of the results to other populations or comparison of the findings with those of other studies and quanti-

fication of factors for which concepts and measures already existed. The qualitative data allowed the researchers to advance beyond the previous state of knowledge about the relevant domains and measures of psychosocial factors affecting the outcome of return to ambulation after a hip fracture.

Data analysis involved multiple steps that integrated evaluation of both the qualitative and quantitative data. The qualitative narrative data were transcribed, and then reviewed by three blinded independent judges, who identified emergent or recurrent themes. Additional categories were identified by the research team after reviewing both the transcripts and the published literature. Eighteen possible dimensions were identified. After review of an additional ten transcripts, the number of domains was reduced to 13, which were grouped into three composite variables. Based on these initial analyses, a narrative coding instrument was developed, which measured these factors on seven-point Likert scales. The coding sheet was pretested by the three independent judges on five transcripts, refined, and further refined on another 20 transcripts.

Using the refined instrument, interrater reliability and internal consistency for the scales were assessed by two judges independently rating 20 transcripts. Alpha reliability was greater than 0.70 for all dimensions except one, which was dropped. The instrument was then used to score the remaining 60 transcripts.

The scores on these newly developed scales, and the scores on the previously developed formal scales, were used as independent variables in subsequent quantitative analyses. These analyses used a repeated-measures analysis of variance approach to examine changes in ambulation at three- and six-month follow-up periods, controlling for multiple potential confounding variables.

The study identified three new categories of meaning: explanatory models, sense of disability, and futurity. Individuals who perceived the fracture in an external or a mechanical fashion, and those whose perception of disability was consistent with greater autonomy, independence, and connectedness, showed greater improvement in ambulation at three-and six-month follow-ups.

The use of quantitative sampling, measurement of previously conceptualized independent variables and outcome measures, and analyses allowed the study to achieve internally valid results that can be generalized to other settings. However, if the study had used only these quantitative techniques, its contribution of new knowledge to the literature would have been small. By incorporating injury narratives and participant observation as primary data collection techniques, the researchers advanced understanding of the experience of hip fracture and identified new domains of meaningful ways of thinking about the illness from the patient's perspective. This type of information has both clinical and hypothesis-generating utility. In addition, by quantifying the measurement of these new domains, the researchers were able to examine their predictive ability for an important functional outcome. Thus, within a single multimethod study, existing hypotheses were tested, new understanding and measures were developed, and the reliability and predictive validity of these new measures were tested. This approach was very likely more time-efficient and cost-effective than separate studies would have been for these purposes. The insights from this study will likely lead to a clinical trial to evaluate the effect of an intervention designed around these domains.

CONCLUSION

Qualitative and quantitative methods have different strengths and weaknesses. The approaches differ in study design, data collection, and analytic techniques. The appropriate methodology depends on the research question, the setting, the state of current theory and knowledge, the availability of valid measurement tools, and the proposed uses of the information to be gathered.[1] There may be situations in which the exclusive use of a qualitative approach or a quantitative one is best. However, most research endeavors can benefit from formally incorporating a multimethod approach, regardless of which paradigm the researchers prefer. By using a multimethod approach either sequentially or concurrently, researchers improve the efficiency of the research process and increase the likelihood of reaching conclusions that are relevant, valid, and generalizable.

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