ONE

DEFINITION AND OVERVIEW OF MIXED METHODS DESIGNS

Information you will find in this chapter: *This chapter opens with a review of the definition and characteristics of mixed methods research as it is used in health sciences. In the second section, we describe major considerations in mixed methods study design, including strategies for integration and the relative timing of when each component is carried out. The subsequent sections review the three basic types of mixed methods designs in more detail. Finally, we highlight two additional mixed methods designs increasingly common in health sciences research.*

Key features in this chapter:

- Brief quotations and reflections from mixed methods researchers
- Figure synthesizing characteristics of qualitative, quantitative, and mixed methods research
- Figures depicting each of the basic types of mixed methods designs
- Brief illustrative examples from the peer-reviewed empirical literature with commentary on integration and timing

DEFINITION AND CHARACTERISTICS OF MIXED METHODS RESEARCH

Mixed methods research draws from multiple scientific traditions and disciplinary backgrounds. As applied in health sciences, using mixed methods may

mean supplementing the perspectives of clinical and health services research with those of disciplines as varied as anthropology, psychology, sociology, economics, education, epidemiology, and genetics. It is perhaps then no surprise that there are many definitions of mixed methods, each reflecting different methodological assumptions and perspectives. Therefore, we propose a clear, concise definition so that readers from diverse backgrounds will share a common understanding of mixed methods as it is used in this book. Incidentally, a shared understanding is also a critical first task for mixed methods research teams, who must be able to approach their work with a unified mixed methods lens. Individuals trained in different disciplines are likely to have substantially different perspectives and professional languages. The diversity inherent in mixed methods research teams, though challenging, can be an extraordinary asset.

For our purposes, we adopt the definition of mixed methods developed by Johnson, Onwuegbuzie, and Turner (2007) based on a systematic synthesis of 19 previously published definitions:

> Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration. (p. 123)

► Strategies for facilitating effective communication and collaboration across mixed methods teams are presented in Chapter 9: Managing Mixed Methods Teams.

This definition, like many definitions of mixed methods, highlights the interplay of qualitative and quantitative methods in a single research study. Establishing a mixed methods definition is an important first step; however, even when researchers agree on a definition, diversity in disciplinary and methodological expertise can get in the way of effective communication and productive collaboration.

Individuals trained in different methodological approaches may have trouble agreeing on precise definitions and differentiating essential terms from frustrating jargon. Collaboration can be enhanced by team members having "methodological bilingualism," or a minimum competency in both

methodologies to enable effective communication and successful integration of findings (Tashakkori & Teddlie, 2003). One tool to facilitate bilingualism is a glossary, which provides clear definitions of key content and methodological terms. At the end of the book you will find a glossary that includes concepts commonly used in qualitative and quantitative methods, with particular emphasis on the mixed methods terms, which are most likely to be new or unfamiliar to our readers.

We also include suggested illustrative citations or resources for further reading on each concept. Please note there are many other possible appropriate citations; these are only included as a possible starting point. We encourage you to take a moment to scan the Glossary of Key Terms and Definitions for any terms that may be unfamiliar and to turn to the suggested resources and other published reference texts for additional information.

► See the Glossary of Key Terms and Definitions at the end of the book.

The definition of mixed methods that we are using captures the respective contributions of qualitative and quantitative inquiry and emphasizes the interaction of these approaches at multiple levels and stages throughout a research study. Because a central premise of this definition is that qualitative and quantitative approaches are complementary in nature, it is important to understand these complementary attributes as well as the defining features of mixed methods. In Figure 1.1, we present a schematic of key characteristics of qualitative, quantitative, and mixed methods research. We chose a Venn diagram in order to reflect the qualitative and quantitative as distinct traditions, each with essential distinguishing characteristics. Yet we also connect them with inward pointing arrows in order to convey that these scientific traditions exist on a continuum of methodologies, with mixed methods sitting in the nexus of their intersection.

Although quantitative methods have historically been the primary approach in health sciences research, many contemporary phenomena in health and health care are difficult, if not impossible, to measure using quantitative approaches alone. Examples include complex and dynamic social processes; beliefs, values, and motivations that underlie individual health behaviors; and social, political, economic, and organizational contexts relevant to health. In cases in which little is known about the research topic, an exploratory qualitative approach is warranted in order to inform further research. Qualitative methods focus on the quality, or essence, of a phenomenon, using an inductive

Figure 1.1 Characteristics of Qualitative, Quantitative, and Mixed Methods Research

lens to gain insights from "the ground up" (Glaser & Strauss, 1967; Miles & Huberman, 1994). The goal is to produce depth of understanding, and perhaps generate hypotheses regarding a phenomenon, its precursors, and its consequences. Qualitative investigation occurs in natural (as compared to controlled or experimental) settings. Qualitative study samples are purposeful in design, with deliberate inclusion of individuals who have direct experience with or knowledge of the focal topic (sometimes called "key informants"). Data analysis involves iterative processes of data collection, coding, and interpretation. Potential products or outputs from qualitative analysis can include recurrent themes, hypotheses, taxonomies, conceptual models, or quantitative survey instruments (Bradley, Curry, & Devers, 2007).

Similarly, other phenomena in health and health care can be characterized using quantitative approaches. Examples include health care costs, utilization patterns, biologic and physiologic characteristics of patients, and prevalence and magnitude of health conditions. Quantitative methods, which are deductive in origin, focus on quantifying phenomenon, using statistical computations to establish prevalence, magnitude, causal associations, and paths (Hulley, Cummings, Browner, Grady, & Newman, 2013; Rothman, Greenland, & Lash, 2008). These methods seek to describe the breadth of phenomena, to generalize and compare across groups, and to test hypotheses. Quantitative studies can be conducted in experimental or natural settings. Random sampling approaches are necessary in order to permit generalizations or inferences to larger populations. Data analysis uses statistical approaches and often accounts for potential confounding factors that may systematically bias the results. Products are measures of statistical significance and association between variables.

When the study phenomenon of interest is multifaceted and includes dimensions that are both qualitative and quantitative in nature, a mixed methods approach is appropriate. Like other types of research, mixed methods studies require deliberate, a priori conceptualization of the phenomenon of interest, as well as its constituent parts. Where mixed methods differs from other approaches is that the phenomenon of interest involves research questions that, by their nature, require both qualitative and quantitative forms of examination, such that the design and findings of one component are central to the other. Mixed methods designs can capitalize on the respective strengths of each approach (Jick, 1979). In Box 1.1, a prominent researcher in the area of health disparities observes that pressing questions in health sciences require diverse forms of both qualitative and quantitative data.

Box 1.1 Adding Relevance to Health Sciences Research Through Mixed Methods

I think that to add to the kinds of questions that are still outstanding [in health research], you need to have both the weight of a large data set to be able to generalize the results, as well as the voices, the experiences of people that you have in qualitative research . . . . That's the only way that you can really try to tackle the problems—is to use all the data that's there.

—Giselle Corbie-Smith, MD, MSc,
Professor of Social Medicine,
University of North Carolina at Chapel Hill

The framing of the study as a single, unified undertaking is essential. Two parallel studies on the same general topic using different methods do not represent a mixed methods design (although we do see this happen in funded grants and published papers). For instance, if the overarching aim of a study is to understand adherence to a complicated nutrition and exercise regime, a mixed methods design might track compliance quantitatively over a defined period and also use qualitative interviews to uncover barriers to adherence from the patient's perspective. In mixed methods studies, the aims, sampling, data, and analysis will include characteristics of both qualitative and quantitative methods. Nevertheless, a mixed methods study is not simply a form of scientific investigation that uses both qualitative and quantitative methods. Rather, there are several fundamental defining features of mixed methods studies: complementarity (or "fit") of qualitative and quantitative components, deliberate integration of quantitative and qualitative findings, and yield to generate insights greater than what could be achieved through one method.

► We examine the complementarity and "fit" of aims and methods in Chapter 3: Determining the Appropriateness and Feasibility of Using Mixed Methods. We address integration of qualitative and quantitative data in depth in Chapter 8: Data Analysis and Integration in Mixed Methods Studies, and we also discuss yield in Chapter 6: Assessing Quality in Mixed Methods Studies.

A core premise in mixed methods is that using complementary methods in pursuit of a

question yields greater insight than would either method alone or both independently. As Einstein observed the limits of singular independent forms of measurement, "Not everything that can be counted counts, and not everything that counts can be counted" (Einstein, attributed). Appreciation for this reality may be one reason that mixed methods research is growing in popularity. In Box 1.2, a health services researcher with substantial experience in mixed methods reflects on the changes he has seen over the past 10 years, with increasing recognition of the value of diverse methods among senior investigators of all backgrounds.

Box 1.2 Growing Acceptability of Mixed Methods

I serve on an NIH study section and it has diverse people on it. There is no one on the section who does not think that mixed methods are appropriate . . . . Even the biostatisticians recognize the need for qualitative work. Ten years ago I saw that, but I don't see it anymore . . . . Even the real hard-core bench scientist, if you talk to them, they get it.

—Benjamin Crabtree, PhD,
Professor and Director of the Department of Family Medicine and Community Health,
Rutgers Robert Wood Johnson Medical School

KEY FACTORS IN MIXED METHODS RESEARCH DESIGNS

Two primary considerations in the overall design of a mixed methods study are (1) precisely how the components will be integrated and (2) the relative timing of when each component is carried out (Creswell, 2013; Creswell & Plano Clark, 2011; Guest, 2013). Although there are other important aspects of mixed methods study design, we focus on these two because they define the fundamental relationship between the various components of the study. The nature of the data required to address the research question determines how the

qualitative and quantitative data will be integrated. Once the overall plan for integration is defined, the timing of each component follows naturally. By focusing first on the nature of the data and the plan for integration, researchers can avoid the kind of post hoc designs that are all too common in our experience as teachers and reviewers, in which data are collected and the research team then tries to fit the data into a design typology retrospectively. It should be noted that while some experts view the relative weight as an important defining criteria (Morse & Niehaus, 2009), others observe that the weights cannot always be determined in advance and that the relative priority of data sets is more likely to be assessed at the data analysis and writing phases (Guest, 2013). Furthermore, weighting can be perceived as a marker for valuing the data, or the amount of resources invested, or the attention devoted in a manuscript. For these reasons, we do not include weighting as a defining feature of mixed methods studies.

Integration of Data

► To read more on data integration, refer to Chapter 8: Data Analysis and Integration in Mixed Methods Studies.

Deliberate, systematic integration of the qualitative and quantitative data generated in each component is essential in order to ensure that "the whole is greater than the sum of the parts" (Barbour, 1999). Approaches to integration include merging, embedding, and connecting the data sets (Creswell, 2013; Creswell & Plano Clark, 2011; Fetters, Curry, & Creswell, 2013).

Merged integration can occur after both the qualitative and quantitative data collection and analyses are completed. The findings are then interpreted in toto and can be compared in order to identify complementarity, concordance, and discordance (or divergence) among data sets. For example, quantitative data may provide information about the accuracy and efficiency of acquiring data with a new diabetes dashboard system, while qualitative data provides information about usability and physician perceptions of the system (Koopman et al., 2011). Findings may emerge as complementary (e.g., they describe different facets of a larger phenomenon such as self-care in patients with heart failure), concordant or discordant (e.g., patient body weight measures do not appear consistently in the quantitative data while in the qualitative interviews patients

report recording their body weight daily). Similarly, in a case study approach, the qualitative and quantitative data can be interpreted together in order to develop a comprehensive understanding of a specific case. For example, in a study examining implementation of a diabetes prevention program in a single community health center, qualitative data may characterize the staff experience of implementation, while quantitative data can be used to track patient-level adherence and outcomes. Taken together, the data can illustrate complementary dimensions of program success or failure (Santana et al., 2010).

Embedded integration occurs typically in studies with both primary and secondary questions, in which different methods are employed to address each question. There is lack of consensus among mixed methods experts on the topic of embedding. Interested readers can find a discussion of the debate in a recent paper by Plano Clark and colleagues (2013). In our own work, we view embedding as occurring when the secondary question (and method) is intended to support the work of the primary question (Greene, 2007) and therefore is nested, or placed, within the framework of the primary method (Creswell & Plano Clark, 2011). The secondary question, while an important part of addressing the primary aim, is not directly and explicitly related to the primary aim. Frequently in health sciences research, a qualitative component is situated within a quantitative intervention trial in order to support development of the intervention and/or to understand contextual factors that could influence the trial outcome (Lewin, Glenton, & Oxman, 2009). For example, patient interviews might be used in the formative stage of designing an electronic monitoring intervention for patients with mental health and chronic disease conditions to be tested in a clinical trial (Cohen, Chinman, Hamilton, Whelan, & Young, 2013).

Connected integration occurs when one type of data builds upon the other. This is the case when one data set is used to define the sample for another component to explain findings from another component. For example, in terms of sampling, a subset of respondents to a quantitative survey might be selected for interviews in the second phase based on their survey responses or scores. Connecting could also occur when one type of data is used to develop measurement tools for the other type of data. This form of connecting is illustrated by the survey development process for a study on the role of religion in later life, which builds upon data from qualitative interviews of older adults

about religiosity to generate key constructs that are operationalized quantitatively in a survey instrument and validated psychometrically (Krause & Ellison, 2009). Some authors have also used the term *building* to describe this second mode of integration (Fetters et al., 2013).

► These presentation formats for mixed methods results are reviewed in detail in Chapter 11: Publishing Mixed Methods Studies in the Health Sciences.

Despite its centrality to mixed methods research, substantive integration is unfortunately not commonly described or reported in the literature. There are a variety of ways in which integrated data can be presented in journal articles. As you will see in the examples described and cited in this book, integration can be accomplished through weaving qualitative and quantitative data in the narrative, juxtaposing the data in figures or matrices, or through transforming and describing data.

Relative Timing

Relative timing of the components in a mixed methods study is determined by the relationship between them; they may be implemented at the same time or in sequence, with one following the other (Morse & Niehaus, 2009). The timing of components has important implications for resources and staffing of the study.

► Resource and logistical considerations are discussed in Chapter 10: Implementation Issues in Mixed Methods Research.

Designs in which all components are carried out simultaneously require sufficient staffing and resources to accomplish the core activities of data collection and analysis. Designs implemented in stages may require fewer staff that can work over the full course of the project on both components, though this depends on whether the researchers are trained in both qualitative and quantitative methods. For instance, consider a study that involves statistical analysis of a large administrative database as well as site visits and in-depth interviews with patients and providers at primary care clinics. Because both components are quite time intensive and need staff with particular training and expertise, conducting the pieces simultaneously may require a large and diverse team.

On the other hand, sequential designs may be less resource intensive at any one point in time yet can be very lengthy in duration. It is not uncommon for a sequential study to run four years or more because the first component of the

study must be fully completed before the next component can be fully designed or implemented. For example, in a mixed methods study using a *positive deviance* approach to understand hospital organizational performance (Bradley et al., 2009), the first stage is to identify the best-performing organizations (the positive deviants) and study them in depth to generate hypotheses to be tested in a subsequent survey of a nationally representative sample of hospitals. The survey instrument cannot be created or administered until the qualitative stage is complete and hypotheses have been generated. The study duration has consequences for funders (who may want more rapid results than possible) and for publishing papers (since a paper integrating both sets of data may well be several years from data collected in the first stage, causing delays in publishing the first stage data).

Implications of Linkages for Methods in Each Component

The linkages across components have important implications for the sampling, data collection, and analysis methods used in each component. For instance, if the aim is to develop a survey informed by a qualitative component using focus groups, the sample for the focus groups must be purposeful on key characteristics salient to the larger population to be included in the survey component (e.g., race or ethnicity, use of long-term care services, socioeconomic status). Procedures for sound sampling and data analysis must be followed for both the quantitative and qualitative data, including cases where one component is supplementary. Ensuring that validity of each method is protected and that standards for rigor are upheld for each component is essential in mixed methods research (Morse, Wolfe, & Niehaus, 2006). On a practical level, the contingent relationship between components requires careful planning. For example, if the qualitative component follows the quantitative component with the aim of explaining quantitative findings, it is essential to allow sufficient time for quantitative data cleaning and analysis before launching the qualitative phase (Creswell, 2013; Creswell & Plano Clark, 2011; Fetters et al., 2013).

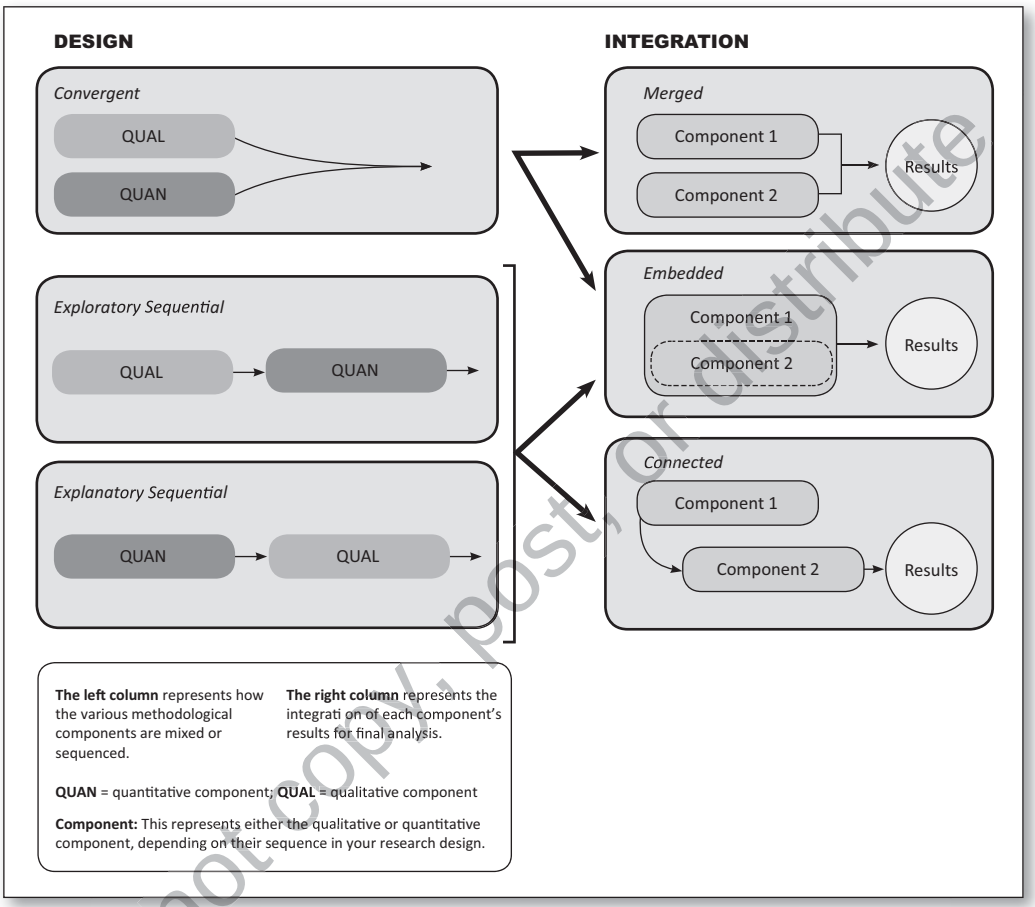
PRIMARY MIXED METHODS STUDY DESIGNS

Typologies to classify specific mixed methods designs can be useful in many ways (e.g., as tools for designing studies, establishing a common language in an emerging field, or conveying legitimacy to new audiences). A number of typologies of mixed methods have been proposed to date, although none have been able to fully accommodate the increasing complexity of approaches, particularly

in large, dynamic health sciences research projects (Guest, 2013). Nevertheless, broad conceptual classification is important to guide our thinking and can be especially useful for novice mixed methods researchers (Collins & O'Cathain, 2009; Teddlie & Tashakkori, 2006). To this end, we draw upon existing typologies—particularly those proposed by Creswell and Plano Clark (Creswell & Plano Clark, 2011)—to offer a relatively simple schematic in Figure 1.2. The two columns in this figure represent independent but related decisions that a research team must make about the study design and about integrating the results of the various components. The left column presents three basic types of mixed methods designs most commonly used in health sciences research: convergent, sequential exploratory, and sequential explanatory. The right column describes study components (rather than specifying QUAL [qualitative component] and QUAN [quantitative component]) in order to show that the qualitative and quantitative components can be used in different ways. For example, in an embedded design the qualitative component could be embedded within the quantitative component or vice versa. The arrows connecting the two columns represent common paths for integration. For example, when a convergent design is used, the integration approach is most often merging or embedding.

The first of the basic design types is the convergent design. In this approach, the quantitative and qualitative components are conducted simultaneously. For example, during a community health needs assessment, researchers may determine that using a survey, interviews, and focus groups are the best way to capture the various types of information needed (e.g., prevalence of conditions, provider experiences, and community perceptions) and to collect data from different types of participants (e.g., those with differing preferences, literacy levels, or degree of comfort with research). Although the data collection for each component is done at the same time, the data may or may not be collected from the same study participants or sample. Quantitative and qualitative data are integrated either through merging the two data sets or embedding one within the other, as shown in Figure 1.2. In integrating the data from the different components, the aim is to balance the respective strengths and weaknesses of these methods in order to maximize the yield of distinct potentially complementary sources of evidence. Ongoing synthesis of information, referred to as triangulation, occurs throughout the process of data collection in order to generate a rich, multidimensional description of a case. Triangulation is a process by which a single phenomenon is examined with multiple observers, theories, methods, or data sources to generate a more comprehensive understanding of social phenomena.

Figure 1.2 Mixed Method Design and Integration Types



The second design is the exploratory sequential design. In this approach, the qualitative component occurs first and is followed by a quantitative component. The qualitative component may therefore generate stand-alone findings as well as inform the quantitative component, or it may simply serve a secondary function to support the primary quantitative aim. For instance, a qualitative phase with KIs from a population of interest might generate insights that inform the design of a culturally sensitive intervention. The data may be integrated through embedding or connecting, as shown in Figure 1.2.

► See the Glossary of Key Terms and Definitions for more information on triangulation.

The third design is the explanatory sequential design. In this design, the quantitative component is followed by a qualitative component. An explanatory design is typically chosen when the team anticipates the quantitative measures will not be wholly sufficient to address the research question. The data collection and analysis for the quantitative component is completed first, and may generate findings that are incomplete or difficult to interpret. The qualitative component is then implemented in order to generate further insights or clarification that may assist in explaining the quantitative findings. Explanatory designs may also be used when quantitative information is required in order to develop the sample for the qualitative phase. This approach often, though not always, uses a common sample (e.g., a purposeful sample is drawn from the larger sample used for the quantitative component). The data are integrated either through embedding or connecting, as shown in Figure 1.2.

At least two additional designs may not be easily classified in this typology, as they reflect one or more elements of the basic designs: intervention studies including a qualitative component and mixed methods case studies. Including a qualitative component within quantitative studies of complex interventions is becoming increasingly common (see Lewin et al., 2009) and is referred to as a concurrent embedded design. In this approach, the qualitative component can examine whether the intervention was delivered as intended, describe implementation processes, generate an understanding of why the intervention failed to work, or demonstrate how its effectiveness was promoted or limited in the real world. The qualitative component can be positioned before, during, or after the intervention study. Importantly, qualitative findings can also help mitigate publication biases against studies lacking intervention effectiveness by both explaining negative results and informing subsequent research.

A case study design using mixed methods is also valuable in health services and clinical research; a defining feature of this design is the deliberate, intense focus on a single phenomenon while understanding its real-world dynamic context (Yin, 1999). Defining the case and developing a guiding operational framework (or theory of change) are challenging yet critical first steps in this approach as they guide the specific questions to be asked through data collection. Any combination of the basic designs described previously might be used in a case study approach. Rigorous case studies employ a range of data collection methods such as the systematic review of archival or clinical data, statistical analysis of large administrative billing data sets, in-depth interviews with health care providers, and field observations of clinical encounters.

Researchers using case studies often use triangulation techniques.

Basic designs can also be expanded or aligned in different ways in order to create a multistage study. Multistage studies are complex, large in scope, and commonly three or more years in duration; they may include both exploratory and explanatory designs. For example, a quantitative phase might be followed by a qualitative phase, which in turn is followed by a quantitative phase. In this instance, quantitative methods may be used to identify a particular information rich subsample (e.g., emergency rooms with the highest volume of H1N1 cases in a given year) to be studied qualitatively in order to generate hypotheses to be tested in a third quantitative phase.

► For more information on seeking funding for mixed methods projects, see Chapter 4: Writing a Scientifically Sound and Compelling Grant Proposal for a Mixed Methods Study. For tips on communicating with funders about project expectations, see Chapter 10: Implementation Issues in Mixed Methods Research.

A final characteristic of mixed methods studies is that they may be either fixed or emergent in nature. In a fixed design, the entire study design is conceptualized at the outset, where the aims and methods for qualitative and quantitative components are explicitly defined. In an emergent design, the components are not planned in detail in advance of the study but rather emerge from the early phases of the project. Investigators proposing a study with an emergent design face several unique challenges in seeking funding and establishing project expectations with funding sources.

EXAMPLES FROM PEER-REVIEWED PUBLISHED LITERATURE

The following section presents a set of illustrative examples from mixed methods studies that have been published in peer-reviewed scientific literature in the health sciences. We feature examples of each of the three main types of mixed methods designs, including convergent, exploratory sequential and explanatory sequential as well as examples of an intervention study with a qualitative component and a case study. We deliberately selected representative papers from a range of journals and topic areas. We present the article abstract (reprinted verbatim from the published paper) as well as brief commentary regarding aspects of integration and timing for each study. We

focus on describing these aspects of the studies because they are unique and critical to mixed methods designs. The integration commentary illustrates both how the data were integrated (through merging, connecting, and embedding) and presented. In addition, each example is accompanied by a figure to represent the overall design as well as integration and timing elements. We developed these figures based on information presented in the published articles as well as communication with the authors. Figures, or procedural diagrams, can be very useful tools for researchers to represent the various aims, study components, and products concisely. Readers interested in further detail are encouraged to read the primary papers.

Convergent Design

Box 1.3 Abstract From a Study That Used a Convergent Design

Maiorana, A., Steward, W. T., Koester, K. A., Pearson, C., Shade, S. B., Chakravarty, D., & Myers, J. J. (2012). Trust, confidentiality, and the acceptability of sharing HIV-related patient data: Lessons learned from a mixed methods study about health information exchanges. *Implementation Science, 7*(34).

Abstract

Background: Concerns about the confidentiality of personal health information have been identified as a potential obstacle to implementation of Health Information Exchanges (HIEs). Considering the stigma and confidentiality issues historically associated with human immunodeficiency virus (HIV) disease, we examine how trust—in technology, processes, and people—influenced the acceptability of data sharing among stakeholders prior to implementation of six HIEs intended to improve HIV care in parts of the United States. Our analyses identify the kinds of concerns expressed by stakeholders about electronic data sharing and focus on the factors that ultimately facilitated acceptability of the new exchanges.

Methods: We conducted 549 surveys with patients and 66 semi-structured interviews with providers and other stakeholders prior to implementation of the HIEs to assess concerns about confidentiality in the electronic sharing of patient data. The patient quantitative

data were analyzed using SAS 9.2 to yield sample descriptive statistics. The analysis of the qualitative interviews with providers and other stakeholders followed an open-coding process, and convergent and divergent perspectives emerging from those data were examined within and across the HIEs.

Results: We found widespread acceptability for electronic sharing of HIV-related patient data through HIEs. This acceptability appeared to be driven by growing comfort with information technologies, confidence in the security protocols utilized to protect data, trust in the providers and institutions who use the technologies, belief in the benefits to the patients, and awareness that electronic exchange represents an enhancement of data sharing already taking place by other means. HIE acceptability depended both on preexisting trust among patients, providers, and institutions and on building consensus and trust in the HIEs as part of preparation for implementation. The process of HIE development also resulted in forging shared vision among institutions.

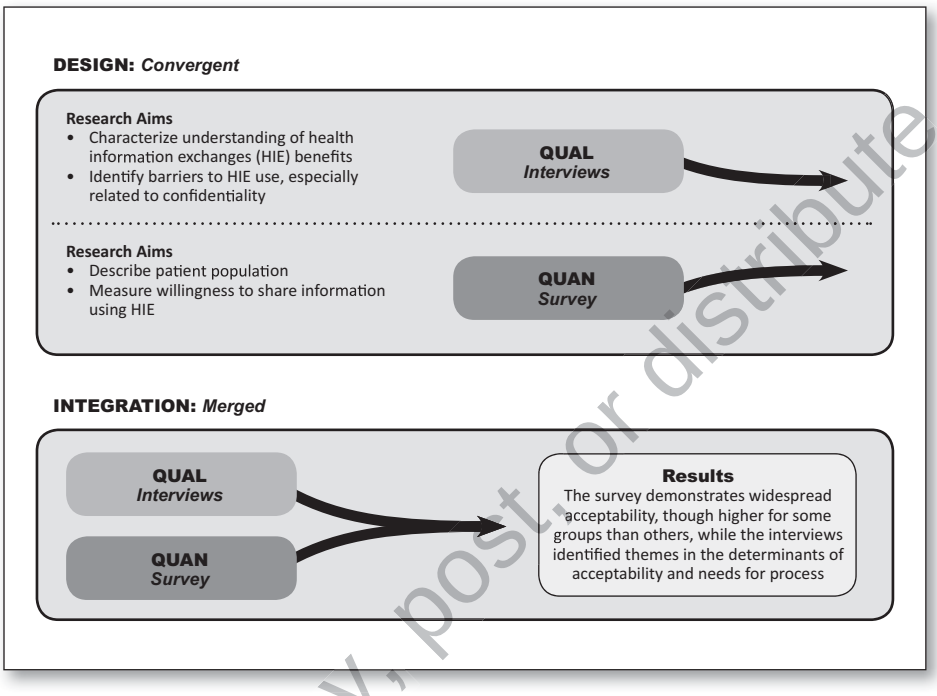
Conclusions: Patients and providers are willing to accept the electronic sharing of HIV patient data to improve care for a disease historically seen as highly stigmatized. Acceptability depends on the effort expended to understand and address potential concerns related to data sharing and confidentiality, and on the trust established among stakeholders in terms of the nature of the systems and how they will be used.

As described in Box 1.3, Maiorana and colleagues (2012) explored how patient trust in technology, processes, and people might influence the acceptability of patient data sharing in the context of health information exchanges (HIEs). Quantitative data from patients (n = 549) describe willingness to share their data with a range of interested parties, while semi-structured interviews with stakeholders (n = 66) explore potential barriers and facilitators to implementation of HIEs. Shown in Figure 1.3, the two primary defining characteristics of this convergent design—integration and timing—are summarized next.

Integration

The patient survey, administered using an audio computer-assisted self-interview method, measured patient willingness to share information using

Figure 1.3 Example Study Design: Convergent Design With Merged Integration



SOURCE: Figure created based on data from Maiorana et al. (2012).

NOTE: QUAL = qualitative component; QUAN = quantitative component.

HIE with a diverse set of potential care providers and insurers (for example, "I am willing to allow my personal health information to be shared with my private health insurers using a secure electronic network"), on a 5-point scale ranging from strong disagreement to strong agreement. The qualitative interviews, conducted in person or over the phone, explored the views of three stakeholder groups: project staff/IT specialists, staff from community-based organizations and public health agencies, and medical providers/staff in clinical settings. The interviews explored technological, attitudinal and structural barriers, and facilitators to acceptability of data sharing, including the issues of trust and confidentiality. Patient and stakeholder views both were considered to provide essential perspectives about acceptability and feasibility of data sharing in this context.

The researchers initially conducted separate analyses of the quantitative patient data and the qualitative stakeholder data. In a subsequent step, they merged the two sets of findings, using the quantitative patient findings to inform and frame the qualitative stakeholder findings. For instance, the patient data revealed few concerns regarding data sharing, while the qualitative data suggested potential factors that mitigate or address such concerns, including familiarity with the use of electronic technology; trust in the institutions; and in the staff providing services, and the expected benefit of HIE. In the paper, the authors presented the quantitative findings in a bar chart rating acceptability on the 5-point scale, then summarized the qualitative findings in a table, and provided detailed explanatory text with illustrative quotes for each.

Timing

The two components were implemented simultaneously across the six participating sites, in advance of HIE implementation. Data collection occurred over a 20-month period as the sites prepared to implement the intervention.

Exploratory Sequential Design

Box 1.4 Abstract From a Study That Used an Exploratory Sequential Design

Ginsburg, K. R., Howe, C. J., Jawad, A. F., Buzby, M., Ayala, J. M., Tuttle, A., & Murphy, K. (2005). Parents' perceptions of factors that affect successful diabetes management for their children. *Pediatrics, 116,* 1095–1104.

Abstract

Objective: To learn which factors parents perceive to be most influential in determining successful type 1 diabetes management.

Methods: A 4-stage mixed qualitative-quantitative method that consists of a series of focus groups, a survey, and in-depth interviews was used to ensure that parents generated, prioritized, and

(Continued)

(Continued)

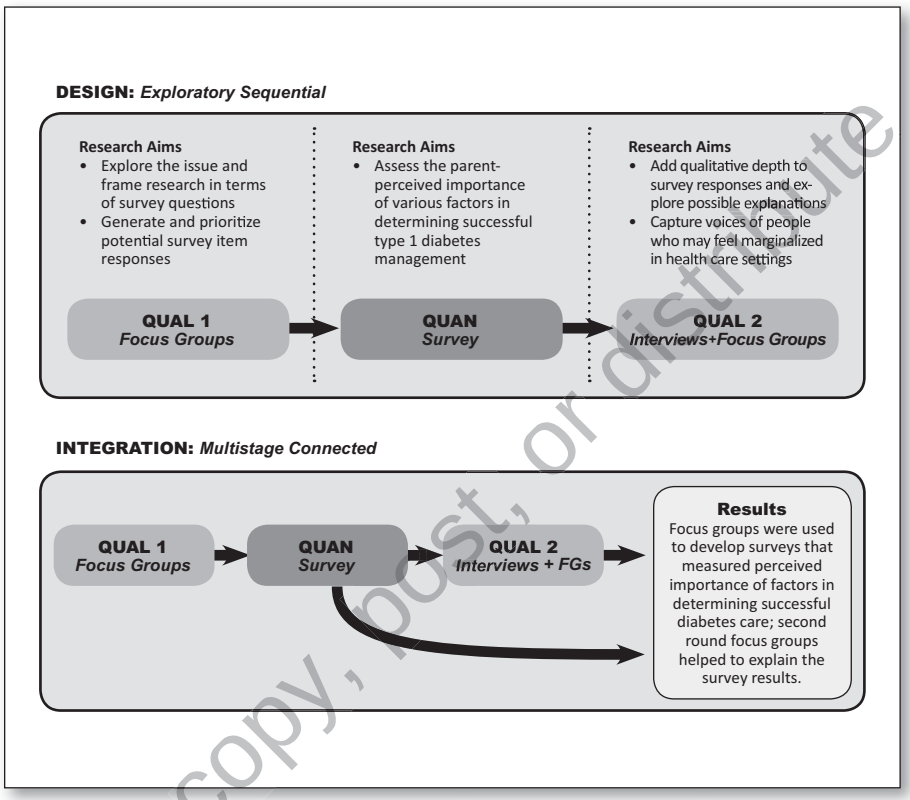
explained their own ideas. In each stage, parents offered a new level of insight into their perception of how children achieve good metabolic control while living as normal a life as possible. The survey responses were divided into statistically different ranks, and the Kruskal-Wallis test was used to compare the results between subgroups.

Results: A total of 149 parents participated in the formative qualitative phases, 799 families (66%) responded to the parent-generated survey, and 67 explanatory interviews were conducted. The families who responded to the survey had children of varied ages (mean: 11.9 years; SD: 4.44) and diabetes control (mean hemoglobin A1c: 8.22%; SD: 1.65); 84.1% of respondents were white, 12.3% were black, and 89% were privately insured. The 30 survey items were statistically discriminated into 8 ranks. The items cover a wide range of categories, including concrete ways of achieving better control, families' or children's traits that affect coping ability, actions of the health care team that support versus undermine families' efforts, and the availability of community supports. No clear pattern emerged regarding 1 category that parents perceived to matter most.

Conclusions: Clinicians can affect many of the factors that parents perceive to make a difference in whether they can successfully raise a resilient child in good diabetes control. Future research needs to determine whether health care teams that address the concerns that parents raised in this study are more effective in guiding children to cope well with diabetes, to incorporate healthier lifestyles, and ultimately to achieve better metabolic control.

As described in Box 1.4, Ginsburg and colleagues (2005) examined parental views on successful management of diabetes for their children. The researchers developed a multistage mixed methods design to ensure parents' perspectives were accurately represented throughout the study from the conceptualization and development of the survey through the interpretation of survey findings. This method was previously utilized by the researchers to capture the perspectives of teens (Ginsburg, 1996; Ginsburg et al., 2002) and has been modified in this case to focus on the unique views of parents.

Figure 1.4 Example Study Design: Exploratory Sequential Design With Multistage Connected Integration



SOURCE: Figure created based on data from Ginsburg et al. (2005).

NOTE: QUAL = qualitative component; QUAN = quantitative component.

Integration

Integration occurred at the data collection and interpretation phases of the study. The results from the first set of focus groups (QUAL 1 in Figure 1.4) were used to develop the survey items in the QUAN phase. The quantitative survey data examine a broad range of dimensions of the parents' experiences, including factors that impact their ability to manage his or her child's diabetes resilience skills, sources of support, and family dynamics. The second set of qualitative data (QUAL 2 in Figure 1.4) was collected after the quantitative survey and used to provide insight into the meaning and interpretation of

specific survey items. For example, one item rated how important it was for the extended family to be able to support the family. Parents described experiencing struggles in balancing competing demands and feelings of burden, as they could not turn to trained and willing family members or other caregivers for respite. Parents also expressed exasperation when clinicians did not understand "that families live with diabetes 24 hours a day and 7 days a week." The qualitative data revealed this item reflected frustration that clinicians are condescending and dismissive of parents' expertise, as well as resentment that clinicians did not understand parents' full scope of competing responsibilities and the implications for diabetes management.

Timing

The four components included a survey, in-depth interviews, and two sets of focus groups. Table 1.1 is taken from the article as a useful example of a summary table describing the stages of data collection, the specific method, the objective, and the sample size for each. These types of summary tables are very useful in grant applications, human investigations committee applications, and

Table 1.1 Study Method Explanation Example

Stage	Method	Objective	*N*
1	Open focus groups	Explore the issue, and frame a question that will generate a wide array of responses.	44 in 7 groups
2	Nominal group technique (NGT)	Generate and prioritize responses. The highest responses are to be included in survey.	105 in 16 groups
3	Parent-developed survey	Assess the importance of each response for the total population and for subgroups.	799
4	Semistructured interviews	Add qualitative depth to the responses and explore solutions.	67
	Explanatory focus groups	Allow people who may feel marginalized in health care settings to express concerns in the safety of a group.	3 groups

SOURCE: Ginsburg et al. (2005).

publications. The table concisely outlines the various data sources and their corresponding sample sizes but perhaps the most important element is the distinct objective of each component. The objectives show the respective contributions of each component and provide a justification for the timing by indicating how the components relate to each other.

Each component built upon findings of the prior component to develop a comprehensive representation of parents' perspectives on successful diabetes management in their families. The design moved from exploratory focus groups to the construction of the survey and back to interviews and focus groups to add insights to the analysis of survey data and to generate potential solutions to challenges faced by parents. While the design is exploratory sequential at the beginning, the final interviews and focus groups also provide some explanatory input. In this way, this design could also be classified as a multistage study.

Explanatory Sequential Design

Box 1.5 Abstract From a Study That Used an Explanatory Sequential Design

Cutter, J., & Jordan, S. (2012). Inter-professional differences in compliance with standard precautions in operating theatres: A multi-site, mixed methods study. *International Journal of Nursing Studies, 49*(8): 953–968. doi: 10.1016/j.ijnurstu.2012.03.001

Abstract

Background: Occupational acquisition of blood-borne infections has been reported following exposure to blood or body fluids. Consistent adherence to standard precautions will reduce the risk of infection.

Objectives: To identify: the frequency of self-reported adverse exposure to blood and body fluids among surgeons and scrub nurses during surgical procedures; contributory factors to such injuries; the extent of compliance with standard precautions; and factors influencing compliance with precautions.

(Continued)

(Continued)

Design: A multi-site mixed methods study incorporating a cross-sectional survey and interviews.

Settings: Six NHS [National Health Service] trusts in Wales between January 2006 and August 2008.

Participants: Surgeons and scrub nurses and Senior Infection Control Nurses.

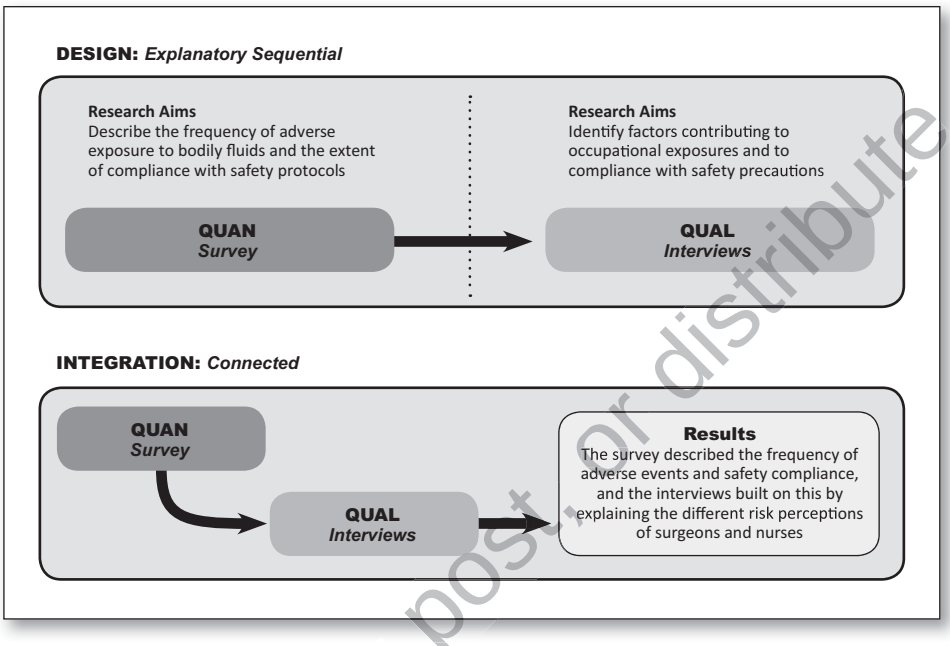
Methods: A postal survey to all surgeons and scrub nurses, who engaged in exposure prone procedures, followed by face-to-face interviews with surgeons and scrub nurses, and telephone interviews with Senior Infection Control Nurses.

Results: Response rate was 51.47% (315/612). Most 219/315 (69.5%) respondents reported sustaining an inoculation injury in the last five years: 183/315 (58.1%) reported sharps' injuries and 40/315 (12.7%) splashes. Being a surgeon and believing injuries to be an occupational hazard were significantly associated with increased risk of sharps' injuries (adjusted odds ratio 1.73, 95% confidence interval 1.04–2.88 and adjusted odds ratio 2.0, 1.11–3.5, respectively). Compliance was incomplete: 31/315 (10%) respondents always complied with all available precautions, 1/315 (0.003%) claimed never to comply with any precautions; 64/293 (21.8%) always used safety devices, 141/310 (45.5%) eye protection, 72 (23.2%) double gloves, and 259/307 (84.4%) avoided passing sharps from hand to hand. Others selected precautions according to their own assessment of risk. Surgeons were less likely to adopt eye protection (adjusted odds ratio 0.28, 0.11–0.71) and to attend training sessions (odds ratio 0.111, 0.061–0.19). The professions viewed the risks associated with their roles differently, with nurses being more willing to follow protocols.

Conclusion: Inter-professional differences in experiencing adverse exposures must be addressed to improve safety and reduce infection risks. This requires new training initiatives to alter risk perception and promote compliance with policies and procedures.

In the sequential explanatory study (see Figure 1.5) summarized in Box 1.5, Cutter and Jordan (2012) sought to assess multiple aspects of

Figure 1.5 Example Study Design: Explanatory Sequential Design With Connected Integration



SOURCE: Figure created based on data from Cutter and Jordan (2012).

NOTE: QUAN = quantitative component; QUAL = qualitative component.

compliance with standard precautions in surgery with a focus on examining differences between surgeons and nurses in this area. Prevalence of self-reported adverse exposure events and compliance with precautions was measured quantitatively via a survey (n = 315). Individual provider motivations and behaviors regarding precautions were assessed qualitatively using interviews with surgeons and nurses who had responded to the survey (n = 16).

Integration

Quantitative findings, such as the greater number of surgeons who believed that inoculation injuries are an expected occupational hazard, were connected to and further illuminated by the qualitative data to offer possible explanations for the diversity in views. For example, qualitative

data suggested personality differences such as arrogance and a tendency to take risks among surgeons, as noted in the article: "There is some innate arrogance in anybody who wants to become a surgeon that's just the type of people we are. We all think we are invincible" (p. 959). Another participant similarly explained, "You need to be a risk taker to cut someone open and remove an organ, nurses don't need to take these risks" (p. 959). The researchers reported that findings from the survey and interview data were consistent and complementary. In the paper, quantitative findings are reported in a series of tables comparing results from surgeons and nurses. The qualitative data are presented in the context of the quantitative data to provide additional insights into the findings of the quantitative data.

Timing

The study was implemented in sequence, beginning with a mail survey of scrub nurses and surgeons who routinely performed exposure-prone procedures. The survey was then followed by interviews with purposefully selected participants and a telephone survey of senior infection control nurses from each participating organization. Selection of interviewees was based on their responses to the survey and comprised those with the most extreme views or an excessive number of self-reported inoculation injuries. Infection control nurses from each participating organization were interviewed by telephone to comment on selected aspects of the data, such as availability of training.

Concurrent Embedded Design

Box 1.6 Abstract From a Study That Used a Concurrent Embedded Design

Murtagh, M. J., Thomson, R. G., May, C. R., Rapley, T., Heaven, B. R., Graham, R. H., . . . Eccles, M. P. (2007). Qualitative methods in a randomized controlled trial: The role of an integrated qualitative process evaluation in providing evidence to discontinue the intervention in one arm of a trial of a decision support tool. *Quality & Safety in Health Care, 16*(3), 224–229.

Abstract

Objective: To understand participants' experiences and understandings of the interventions in the trial of a computerised decision support tool in patients with atrial fibrillation being considered for anti-coagulation treatment.

Design: Qualitative process evaluation carried out alongside the trial: non-participant observation and semi-structured interviews.

Participants: 30 participants aged > 60 years taking part in the trial of a computerised decision support tool.

Results: Qualitative evidence provided the rationale to undertake a decision to discontinue one arm of the trial on the basis that the intervention in that arm, a standard gamble values elicitation exercise was causing confusion and was unlikely to produce valid data on participant values.

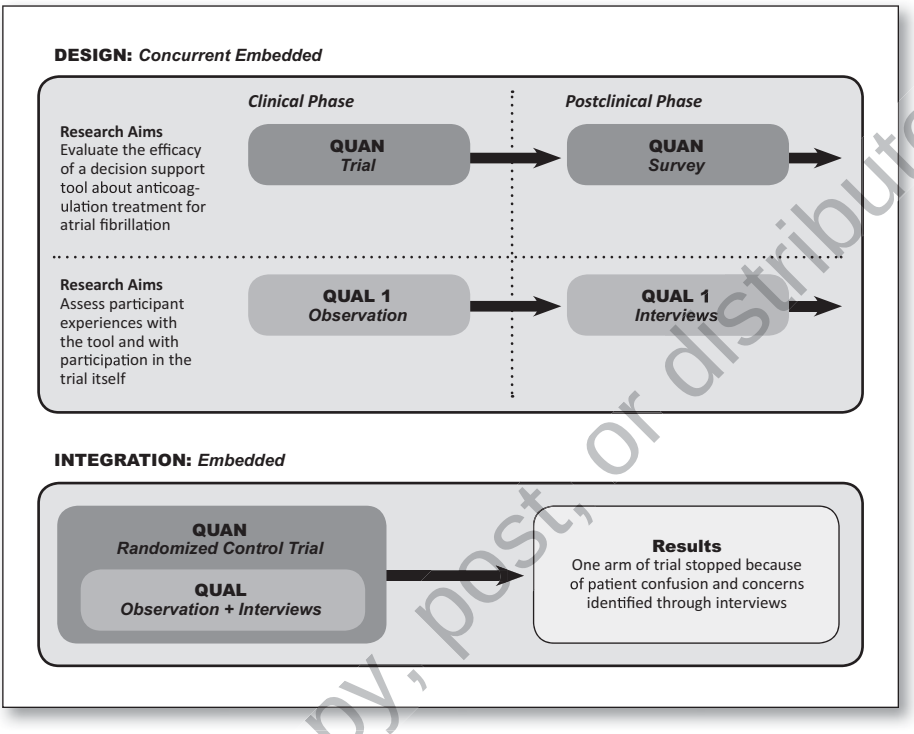
Conclusions: Qualitative methods used alongside a trial allow an understanding of the process and progress of a trial, and provide evidence to intervene in the trial if necessary, including evidence for the rationale to discontinue an intervention arm of the trial.

As shown in Box 1.6, a study by Murtagh and colleagues (2007) involved behavioral intervention—a randomized controlled trial of a decision support tool to guide patients with atrial fibrillation in making a choice about anticoagulation treatment. Because the intervention was complex, the researchers built in a qualitative process evaluation to assess participant experiences with the tool and with participation in the trial itself.

Integration

In this study, the qualitative data were not integrated into the findings of the trial per se but rather informed the design of the trial itself. These data ultimately provided sufficient evidence to terminate one arm of the trial (see Figure 1.6). The qualitative findings were reviewed by the full team, which decided on the basis of these data to discontinue an arm of the trial. In the published paper, the qualitative data are presented in a brief case format, with excerpts from the interviews to demonstrate participants'

Figure 1.6 Example Study Design: Concurrent Embedded Study With Embedded Integration



SOURCE: Figure created based on data from Murtagh et al. (2007).

NOTE: QUAN = quantitative component; QUAL = qualitative component.

inability to understand and carry out a key aspect of the study (the hypothetical scenarios gamble exercise).

Timing

Qualitative methods may be employed in pretrial development, during implementation, and subsequent to the trial. In this study, the qualitative and quantitative components were run concurrently, where the qualitative component was a "thematic observational analysis" of the trial. The first thirty participants in the trial were invited to complete interviews and videotaped consultations. The qualitative arm was specifically designed to generate real-time insights into the participants' experiences in order to characterize the process of implementing the trial and the evidence to discontinue if warranted.

Case Study Using a Convergent Design

Box 1.7 Abstract From a Case Study That Used a Convergent Design

Crabtree, B. F., Miller, W. L., Tallia, A. F., Cohen, D. J., DiCicco-Bloom, B., McIlvain, H. E., . . . McDaniel, R. R., Jr. (2005). Delivery of clinical preventive services in family medicine offices. *Annals of Family Medicine, 3*(5), 430–435.

Abstract

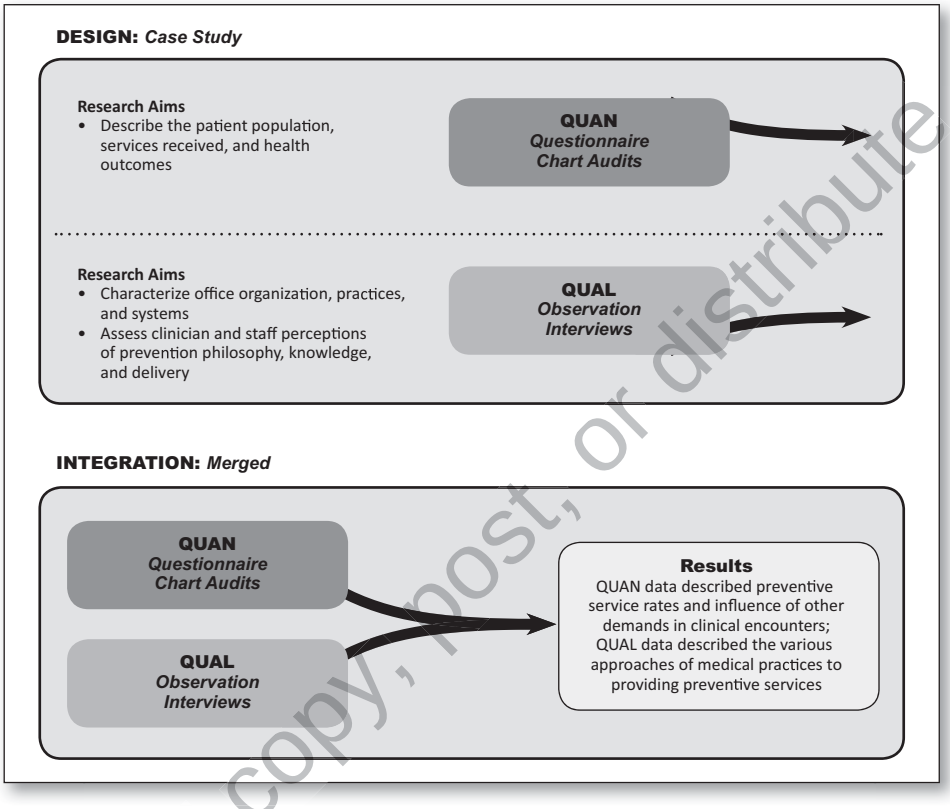
Background: This study aimed to elucidate how clinical preventive services are delivered in family practices and how this information might inform improvement efforts.

Methods: We used a comparative case study design to observe clinical preventive service delivery in 18 purposefully selected Midwestern family medicine offices from 1997 to 1999. Medical records, observation of outpatient encounters, and patient exit cards were used to calculate practice-level rates of delivery of clinical preventive services. Field notes from direct observation of clinical encounters and prolonged observation of the practice and transcripts from in-depth interviews of practice staff and physicians were systematically examined to identify approaches to delivering clinical preventive services recommended by the U.S. Preventive Services Task Force (USPSTF).

Results: Practices developed individualized approaches for delivering clinical preventive services, with no one approach being successful across practices. Clinicians acknowledged a 3-fold mission of providing acute care, managing chronic problems, and prevention, but only some made prevention a priority. The clinical encounter was a central focus for preventive service delivery in all practices. Preventive services delivery rates often appeared to be influenced by competing demands within the clinical encounter (including between different preventive services), having a physician champion who prioritized prevention, and economic concerns.

Conclusions: Practice quality improvement efforts that assume there is an optimal approach for delivering clinical preventive services fail to account for practices' propensity to optimize care processes to meet local contexts. Interventions to enhance clinical preventive service delivery should be tailored to meet the local needs of practices and their patient populations.

Figure 1.7 Example Study Design: Case Study Design With Merged Integration



SOURCE: Figure created based on data from Crabtree et al. (2005).

NOTE: QUAN = quantitative component; QUAL = qualitative component.

In the large, observational comparative case study (using a convergent design) described in Box 1.7 and Figure 1.7, Crabtree and colleagues (2005) sought to understand the organizational features of primary care practice, with a focus on provision of clinical preventive services in this setting. Qualitative methods including interviews with clinicians (n = 57) and staff (n = 71) and observations of both the practice environment and of 30 or more patient encounters with each clinician were used to generate insights into prevention philosophy, knowledge, and delivery in these diverse practice

sites (see Figure 1.7). Analyses focused on describing and understanding differences in rates of clinical preventive service delivery across the practices. Quantitative methods were used to calculate practice rates for three types of services (screening, counseling, and immunization) based on chart reviews, encounter descriptions, and patient exit card responses for 1,637 patients. These data were used selectively to enrich the qualitative data.

Integration

Quantitative and qualitative data from all sources at each practice site were merged to create a descriptive summary of each practice's key characteristics and overall strategy for delivering preventive services. In the paper, service delivery rates are woven into narrative reports from the qualitative and observational data, organized within three overarching themes: competing demands of care, variation in approaches for preventive service delivery, and organizational features that support clinical preventive services.

Timing

As is characteristic in case studies, data collection occurred simultaneously and iteratively at each of 18 purposefully selected practice sites that were diverse with regard to practice size, geographic location, and ownership.

Summary and Key Points

- We use the following definition of mixed methods research: Research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, and inference techniques) for the broad purposes of breadth and depth of understanding and corroboration.
- Primary factors to consider in mixed methods design are strategies for integration and relative timing of the components.
- Three core designs are convergent, explanatory sequential, and exploratory sequential; additional designs common in health sciences are qualitative methods in intervention trials and case studies.

Review Questions and Exercises

1. Think about a topic of interest to you that would be impossible to carry out successfully using only qualitative or quantitative approaches. What are the limitations of using each method independently, and how could a mixed methods study address those limitations?
2. Suppose you are reviewing the literature related to lack of adherence to HIV treatment in low-income settings. How might an embedded mixed methods design be used to study this topic?
3. Select two or three published articles that use a mixed methods design. First, create a diagram to illustrate the study design. Discuss the timing of collecting the qualitative and quantitative data. Finally, describe how the data are integrated.

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