The nature and design of mixed methods research

This section addresses three issues:
1. Background of mixed methods
2. Qualities of mixed methods projects
3. Methodological challenges in mixed methods investigations

Background of mixed methods

Definitions and names for mixed methods research have evolved with the field over 20-30 years (e.g., Johnson, Onwuegbuzie, & Turner, 2007; Pluye & Hong, 2014; Creswell, 2015; Gallo & Lee, 2015). For this report, we posit mixed methods research as a methodological approach that:

- Focuses on research questions that call for real-life contextual understanding, multi-level perspectives, and cultural influences;
- Employs rigorous quantitative research that assesses the magnitude and frequency of constructs and rigorous qualitative research that explores the meaning and understanding of constructs;
- Involves multiple types of data (e.g., geospatial points, in-depth oral interviews, survey questionnaire responses, text messages, and visuals including emoji, photos, and other graphics);
- Intentionally integrates these data and analyzes them systemically to maximize the strengths and counterbalance the weaknesses of each data type; and,
- Frames the investigation within philosophical and theoretical frameworks.

Philosophy in mixed methods research. Those new to mixed methods research might wonder how this or any approach can bridge the constructivist and empiricist worldviews inherent in qualitative and quantitative designs, respectively (DePoy & Gitlin, 2015). Indeed, much qualitative research draws upon the constructivist perspective to understand human perceptions associated with health, wellness, disease, recovery, and other health related issues. Randomized controlled trials are the ultimate reflection of objective empiricism, to test hypotheses. Researchers rooted in discrete philosophical positions may find that initial ventures into mixed methods research may challenge their respective beliefs (Greene, 2007; Curry et al., 2012).

Rather than challenge beliefs, this report suggests that the mixed methods approach draws upon the philosophical approach pragmatism. An oversimplified explanation of pragmatism is that humans use scientific knowledge to explain changing natural and human conditions (Peirce, 1878; James, 1907, 1909; see also, Greene, 2007; Pluye & Hong, 2014).
In other words, mixed methods research provides an opportunity for multiple methods and their philosophical traditions to generate new knowledge through dialectical discovery and practice. Like pragmatism, mixed methods research focuses first on research problems and questions, values objective and subjective knowledge, and draws upon diverse design and methods (Morgan, 2007; Pluye & Hong, 2014). Mertens (2009) posits that mixed methods research is a transformative perspective that permeates the entire research process, from the problem to the conclusions, and the use of results.

**Theories and mixed methods research.** Optimally, all studies draw upon one or more theoretical frameworks from social, behavioral, or biological sciences to inform all study phases. Mixed methods studies inherently provide opportunities to integrate a variety of theoretical perspectives (e.g., complexity theory, critical theories, ecological theories, stress theory).

**The nature of qualitative research and its evidence.** A salient strength of qualitative research is its focus on contexts and meanings of human lives and experiences for inductive or theory-development driven research. It is a systematic and rigorous form of inquiry that uses data collection methods including in-depth interviews, ethnographic observation, and review of documents. Qualitative data help researchers understand processes, especially those that emerge over time, provide detailed information about setting or context, and emphasize the voices of participants through quotes. Qualitative methods facilitate data collection when measures do not exist and provide a depth of understanding of concepts. Qualitative approaches in health research include case studies, discourse analysis, ethnography, grounded theory, and phenomenology.

**The nature of quantitative research and its evidence.** Quantitative research tests theories or hypotheses, gathers descriptive information, or examines relationships among variables. These variables are measured and yield numeric data that can be analyzed statistically. Quantitative data have the potential to provide measurable evidence, to help to establish (probable) cause and effect, to yield efficient data collection procedures, to create the possibility of replication and generalization to a population, to facilitate the comparison of groups, and to provide insight into a breadth of experiences. Typical quantitative approaches in the health sciences are case-control studies, descriptive surveys, observational studies, pragmatic clinical trials, randomized controlled trials, and time-series designs.

**The combination of quantitative and qualitative data.** Mixed methods research begins with the assumption that investigators gather evidence based on the nature of the health-related question as well as the social, behavioral, and biomedical theoretical orientations associated with the project. Social inquiry considers an individual's behavior in relation to a group, a population, or social institutions including families and organizations (e.g., hospitals, schools). Quantitative methods are mainly deductive and ideal to measure pervasiveness of "known" phenomena and central patterns of association, including inferences of causality. Qualitative methods are mainly inductive and allow for identification of previously unknown processes, explanations of why and
how phenomena occur, and the range of their effects (Pasick et al., 2009; Pollock, 2012; Peter, 2015).

Mixed methods research involves the intentional collection of both quantitative and qualitative data to combine the strengths of each to answer research questions. This approach is more than simply collecting qualitative data from interviews, or collecting multiple forms of qualitative evidence (e.g., interviews, observations, photos) or multiple types of quantitative evidence (e.g., diagnostic tests, surveys) could provide. Rather, analyses of these multiple forms of data facilitate a more comprehensive understanding of health problems and means to ameliorate them than a sole data type or concurrent collection and analyses of multiple forms of data (e.g., O’Cathain, Murphy, & Nichol, 2008; Lewin, Glenton, & Oxman, 2009; Fetters, Curry, & Creswell, 2013).

**The integration of multiple forms of data.** In mixed methods studies, investigators intentionally integrate quantitative and qualitative data. The basic concept is that integration of quantitative and qualitative data maximizes the strengths and minimizes the weaknesses of each type of data. This idea of integration separates current views of mixed methods from older perspectives in which investigators collected both forms of data, but kept them separate or casually combined them rather than using systematic integrative procedures. One of the most difficult challenges is how to integrate different forms of data. Four approaches have been discussed in the literature: connecting, building, merging, and embedding data (Creswell & Plano Clark, 2017; Fetters, Curry, & Creswell, 2013; Sandelowski, Voils, & Knafl, 2009; Scammon et al., 2013; Tomoaia-Cortisel et al., 2013).

- **Connecting data** occurs through the sampling frame. It involves analyzing one dataset (e.g., a quantitative survey), and then using the analytical results to inform subsequent data collection (e.g., interview questions, identification of participants to interview). In this way, the integration occurs by connecting the analysis of results from the initial phase with the data collection from the second research phase.
  - For example, a NIAAA-funded project with non-abusing drinkers diagnosed with hepatitis C had an initial qualitative component based on interviews and Internet postings to describe new decision factors related to curtailing alcohol consumption. Investigators used these findings to develop new items for a quantitative instrument, administered in the second phase to assess the prevalence of the new factors and their association with current drinking (cf. Stoller et al., 2009).

- **Building data** occurs when the results from one dataset informs a subsequent approach to collect data. For example, a research team might create survey research questions based on the argot or cultural constructs of specific target populations. This subsequent survey instrument would collect data to answer hypotheses that emanated from the initial data collection. The NIAAA-funded project also serves as a building-data example given that the first set of findings also led to the development of a quantitative instrument.
In addition, the first stage of a four-site NIDA-funded project with illegal drug users conducted extended interviews on sociodemographics, life history; terms for and personal meanings of sexual activities, knowledge on sexually transmitted infections including HIV, attitudes toward risk reduction practices including and risk-reduction behaviors during types sexual encounters. Data analysis found participants to attribute unique meanings to standard sexual terminology used in previous questionnaires. Also apparent was a social hierarchy that informed participants’ risk and risk-reduction behavior, based on where a participant perceived a partner’s status in the social hierarchy. The research team used these data to create intervention curriculum, survey questionnaires, and qualitative publications (e.g., Elwood & Greene, 2003; Elwood & Vega, 2005).

- **Merging data** combines qualitative data (e.g., images or texts) with quantitative data to compare and analyze. This integration can be achieved by reporting results together in a discussion section of a study, such as reporting first the quantitative statistical results followed by qualitative quotes or themes that support or refute the quantitative results. It also can be achieved by transforming one dataset (e.g., counting the occurrence of themes in a qualitative dataset) so that the transformed qualitative results can be compared with the quantitative dataset. One also can use tables or figures that display both quantitative and qualitative results.

- For example, Wittink, Barg, and Gallo (2006) studied the concordance and discordance between physicians and patients about depression status. The parent study for this research was the Spectrum Study (2001-2004), supported by multiple NIMH grants (MH62210-01, MH62210-01S1, MH67077). Data were collected from patients aged 65 and older. Quantitative data consisted of ratings of depression from physicians as well as self-reported patient ratings of depression and anxiety. Qualitative data consisted of semi-structured interviews with patients. On the rating scales, the standard measures did not differentiate patients whose physicians rated them as depressed from those whose physicians did not rate them as depressed. Qualitative themes, however, identified a typology of differing emotions and feelings by patients toward physicians. Differences among the qualitative categories in terms of demographics and quantitative ratings were examined in a table. (cf. Gallo et al., 2005; Wittink, Barg, & Gallo, 2006)

- **Embedding data** involves systematically linking the collection of qualitative to quantitative data at multiple points. One secondary dataset can be embedded within a larger, primary design. Embedding is frequently used in intervention design. For example, supplemental qualitative data on participants’ intervention experience can help researchers adapt an ongoing adaptive intervention. Alternatively, a qualitative data collection may precede an experimental trial to inform development of procedures or follow an experimental trial to help explain the results of the trial.
For example, a NCI-NINR-funded R01 project compared high and low doses of a nurse-led intervention to assist oncology outpatients to manage their pain more effectively. This RCT compared the two treatments in terms of various repeated measure patient outcomes, including pain levels. Embedded within the RCT study, they also gathered qualitative data in the form of audiotapes of the intervention sessions, along with nurse and patient notes, to describe the issues, strategies, and interactions experienced during the intervention. The results provide evaluation of both the outcomes and process of the intervention.

Qualities of mixed methods design

The research methods in any investigation must fit the research problem or question. Research issues most suitable for mixed methods are those in which a quantitative approach or the qualitative approach alone is inadequate to develop multiple perspectives or to provide a comprehensive understanding about a research problem or question. For example, quantitative outcome measures may be better understood if combined with qualitative data. By using mixed methods, health science investigators can answer new questions and more thoroughly capture complex phenomena, hard-to-measure constructs, and interactions in specific settings and contexts as well as in experimental settings.

Another reason is for one database build on another. A qualitative phase may help investigators develop a survey instrument or an intervention. After analyzing followup quantitative data, a qualitative phase may help researchers determine additional qualities or mechanisms suggested by the quantitative results (Plano Clark, 2010). Gallo and Lee (2015) posit that mixed methods can speed translation from a tested randomized controlled trial to evidence-based interventions in real-life settings that often have more complexities than the environments in which funded intervention research occurs. Randomized trials target specific groups of people and, therefore, inherently exclude others.

To adapt an evidence-based intervention for a broad patient group, one might need to account for patients with multiple chronic conditions, multiple perceptions of healthcare systems, unequal health insurance coverage, and healthcare providers who may lack the extensive training a funded research project would have provided interventionists. Qualitative research that follows a proven intervention can provide crucial information for more thorough implementation in community and healthcare settings.

Researchers increasingly use mixed methods within intervention trials to understand participants’ experience with intervention curricula and reasons for drop out or loss to follow-up. Mixed methods may provide clues to how an intervention works by identifying potential mediators from participants’ viewpoints. In implementation research, mixed methods may be central to illuminate how medical practices or providers adapt interventions to specific settings or circumstances. Regardless of purpose, mixed methods studies share some unique considerations:
**Analytic logic.** Discussions about mixed-methods design types available to investigators continue to develop (e.g., Creswell & Plano Clark, 2011, 2017; Fetters, Curry, & Creswell, 2013). Regardless, design possibilities should follow the reasons to involve mixed methods in a research project. They can be differentiated analytically by whether the quantitative and qualitative datasets are integrated for analysis or interpretation to address the research questions, or whether one dataset builds on the results of an initial dataset.

**Timing.** Collection of qualitative and quantitative data may be timed to be collected concurrently or sequentially. Concurrent data collection is attractive to investigators who must maximize the amount of data collected in the field for the time spent. Alternatively, an investigator may collect data in sequence, with one phase of collection followed by another. This approach is useful for investigators who need results from an initial phase to inform a subsequent phase.

**Priority.** In some mixed methods studies, quantitative and qualitative research have equal emphasis. In other studies, priority is given to either the quantitative or the qualitative research. An unequal priority occurs when the investigator embeds a secondary dataset within a larger, primary design or reports unequal quantitative or qualitative components in the study.

**Point of interface.** The “point of interface” (Morse & Niehaus, 2009; Klassen et al., 2012), or the point where mixing occurs, differs depending on the mixed methods design. This “point” may occur during data collection (e.g., when both quantitative items and qualitative open-ended questions are collected on the same survey), during data analysis (e.g., when qualitative data are converted or transformed into quantitative scores or constructs to be compared with a quantitative dataset), during data interpretation (e.g., when results of quantitative analyses are compared with themes that emerge from the qualitative data), or even as the unit of reference (Guest, 2012). This last perspective emphasizes the timing and purpose of data integration.

**Single study or multiphase program of inquiry.** Some mixed methods projects employ a design that is “stand-alone,” a single study conducted by an investigator or a team. Other mixed methods projects (typically proposed in larger NIH-funded projects) consist of multiple studies, some quantitative and some qualitative, that build on each other and contribute to an overall program objective or purpose—for example, to prevent a specific disease or to promote adherence to manage a chronic condition.

**Methodological challenges in mixed methods investigations**

In mixed methods research, there are multiple many methodological issues to anticipate (see Teddlie & Tashakkori, 2009; Gallo & Lee, 2015; Creswell & Plano Clark, 2011, 201;) including,
• **Resources.** Because multiple forms of data are being collected and analyzed, mixed methods research requires extensive time and resources to carry out the multiple steps involved, including the time required for data collection and analysis. [See section on *Building infrastructure and resources*.]

• **Teamwork.** In multidisciplinary, interdisciplinary, and transdisciplinary teamwork, different approaches towards investigating and writing might emerge. Team leaders need to anticipate the challenges and benefits of a team approach to mixed methods research [See section on *Forming the mixed methods research team*.].

• **Sampling issues.** Detailed discussions about the sampling issues involved in mixed methods research and in specific designs appear elsewhere (e.g., Teddlie & Yu, 2007; Gallo & Lee, 2015; Creswell & Plano Clark, 2011, 2017). Nevertheless, some challenges specific to concurrent designs (i.e., merging quantitative and qualitative research) include having adequate sample sizes for analyses, using comparable samples, and employing a consistent unit of analysis across the databases. For sequential designs (i.e., one phase of qualitative research builds on the quantitative phase or vice versa), the issues relate to deciding what results from the first phase to use in the follow-up phase, choosing samples and estimating reasonable sample sizes for both phases, and interpreting results from both phases.

• **Analytic and interpretive issues.** Issues often can arise during data analysis and interpretation. When the investigator merges the data during a concurrent design, the findings may conflict or be contradictory. Strategies to resolve them include gathering more data and revisiting the databases. For designs involving sequential data collection, the key issues surround the “point of interface” in which the investigator needs to decide what results from the first phase will be the focus of attention for the follow-up data collection. Interpreting integrated results may be challenging because of the unequal emphasis placed on each dataset by the investigator or team, the accuracy or validity of each dataset, and whether the philosophies related to quantitative or qualitative research can or should be combined.