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Mixed Methods for the Interpretation of Longitudinal Gerontologic Data: Insights From Philosophical Hermeneutics

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Abstract

This article's main objective is to demonstrate that data analysis, including quantitative data analysis, is a process of interpretation involving basic hermeneutic principles that philosophers have identified in the interpretive process as applied to other, mainly literary, creations. Such principles include a version of the hermeneutic circle, an insistence on interpretive presuppositions, and a resistance to reducing the discovery of truth to the application of inductive methods. The importance of interpretation becomes especially evident when qualitative and quantitative methods are combined in a single clinical research project and when the data being analyzed are longitudinal. Study objectives will be accomplished by showing that three major hermeneutic principles make practical methodological contributions to an insightful, illustrative mixed methods analysis of a qualitative study of changes in functional disability over time embedded in the Precipitating Events Project—a major longitudinal, quantitative study of functional disability among older persons. Mixed methods, especially as shaped by hermeneutic insights such as the importance of empathetic understanding, are potentially valuable resources for scientific investigations of the experience of aging: a practical aim of this article is to articulate and demonstrate this contention.

Keywords

mixed methods; hermeneutics; longitudinal data analysis; aging

Mixed methods are increasingly being used in a wide variety of research areas, including clinical biomedical research. With this variety of applications comes a pluralism of philosophical orientations that inform and justify particular mixed methods projects. For instance, the widely used "grounded theory" approach to qualitative data analysis of Glaser and Strauss (Strauss & Corbin, 1998) shows the influence of American pragmatist philosophers and their writings about logical inquiry (Dewey, 1938/2008; Peirce, 1877–1878/1998). Continental phenomenology (Husserl, 1931/1991), with its descriptive attention "to the things themselves," has especially influenced psychologists doing mixed methods research (Moustakas, 1994). Philosophical hermeneutics, the philosophical tradition most influential for this study, has also been recognized as a relevant resource (Miles & Huberman, 1994). What makes philosophical hermeneutics distinctive as a type of philosophy, and valuable for qualitative research, is its focus on the insightful strategies

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people use to understand written texts; these strategies are described, generalized, and used to understand other types of human cultural activities.

What all these philosophical approaches have in common is a rejection of the positivist program for social scientific research such as was advocated by John Stuart Mill in the final book of his, *System of Logic* (Mill, 1872/1987). According to Mill, researchers studying human beings should follow the same methods as have proved successful in physics and other natural sciences. He had high hopes for the predictive power of statistical methods analyzing human agents and relationships (Mill, 1872/1987). He wrote, however, prior to the development of the coefficient of determination and other statistics that allow quantitative researchers to know how much outcome variability they actually account for in their statistical models. Using such statistical resources, Mill's high expectations can be demonstrated to be unrealistic for most behavioral and clinical research.

This article's main objective is to show that data analysis, including quantitative data analysis, is a process of interpretation involving basic hermeneutic principles that philosophers have identified in the interpretive process as applied to other, mainly literary, creations. Among these principles are a version of the hermeneutic circle, an insistence on interpretive presuppositions, and a resistance to reducing the discovery of truth to the application of inductive methods (Table 1). Related objectives are to indicate how this rich conception of interpretation becomes especially evident when qualitative and quantitative methods are combined in a single clinical research project and when the data being analyzed are longitudinal. It will be argued that the element on empathetic understanding that is characteristic of the conception of interpretation featured here gains importance when study results consist of changes in functional health outcomes over time at the end of life. Positivist approaches to scientific research accord little importance to interpretation informed by empathetic understanding. Mixed methods, especially as shaped by hermeneutic insights, can incorporate aspects of this type of understanding, and this makes them potentially valuable resources for scientific investigations of the experience of aging: a practical aim of this article is to articulate and demonstrate this contention.

The Importance of Interpretation

In recommending the resources of philosophical hermeneutics for use in mixed methods research, we are not discounting the validity of other approaches. Rather, we are invoking these resources to make three increasingly specific points. First, regarding data analysis as a task of interpretation can be insightful. Because it involves empathetic understanding as well as logical explanation, interpretation as an intellectual activity accentuates the human individuality of the persons or cultural artifacts it addresses (Ricoeur, 1976). Construing data analysis as an interpretive task accentuates its nature as a fallible human endeavor and mitigates the error of regarding its results as more certain than is appropriate. Second, the interpretive character of data analysis is especially revealed when quantitative data analysis is complemented by qualitative data analysis. When they are well deployed, qualitative methods can help ensure that the inevitably abstract nature of statistical analysis—abstract because it deals most directly with aggregates such as epidemiologic cohorts—is complemented by an understanding of how some individual study participants experience illness and medical treatment. Finally, mixed methods as applied to longitudinal data even more strongly highlight the role of interpretation in data analysis and more directly yield practical analytical benefits. Applicability to longitudinal data is not a topic often mentioned in standard surveys of mixed methods, including texts by Creswell and by Teddie and Tashakkori (Creswell, 2009; Teddlie & Tashakkori, 2009). In longitudinal data analysis, time becomes a factor of major importance. In the past century, human temporality was a major topic of reflection for philosophers in the hermeneutic tradition (Heidegger,

1927/1962; Ricoeur, 1983–1985/1990). Temporality received such notice because the experience of time is complex, individualistic, and crucial to the human experience of aging.

The Context of Clinical Aging Research

Context is important for interpretation; accordingly, we acknowledge the context from which our reflections emerge. We are clinical biomedical researchers who work exclusively with older study participants. Quantitative methods remain central to our research although qualitative methods have become increasingly prominent in the health sciences (Forthofer, 2003). Thus, when qualitative methods are portrayed here as adjunctive to quantitative methods, we are not contending that this should always be the case but are simply acknowledging a reality of a research environment in which quantitative methods predominate. Also, in working with participants who are older, we are working with persons with multiple morbidities and high mortality rates. Clinical attention in geriatric care is not restricted to medical cures—though they are highly desirable to achieve when possible—but is also consistently directed to quality of life and integrity of medical decision making. Because these issues involve deeply personal and individualistic elements, clinical aging research is an especially appropriate context for measuring health outcomes qualitatively as they change over time (Van Ness et al., 2010).

The objectives of this article will be met by presenting an illustrative mixed method analysis of data gathered in the Precipitating Events Project (PEP) of Dr. Thomas Gill. PEP is a longitudinal study of 754 community-living persons aged 70 years or older who initially were nondis-abled in four activities of daily living (bathing, dressing, transferring, and walking). Detailed information about the assembly of the cohort and participant baseline characteristics is available elsewhere (Gill, Allore, Holford, & Guo, 2004; Gill, Desai, Gahbauer, Holford, & Williams, 2001). Participants completed comprehensive assessments at 18-month intervals and were interviewed by telephone monthly to ascertain information about functional disability. Numerous quantitative studies have been conducted and published in this cohort regarding various aspects of functional disability, which has been operationalized as the need for personal assistance with bathing, dressing, transferring, and/or walking. After 108 months of follow-up, a qualitative substudy designed by Drs. Terri Fried and Thomas Gill was conducted with 36 participants in the PEP study who were 80 years or older and were able to answer open-ended interview questions about the nature of and changes in their functional disability. Several basic hermeneutic principles will be shown to assist in the understanding of the results from the PEP quantitative study and its qualitative substudy. Furthermore, they will be shown to have practical implications for the design, implementation, and presentation of mixed methods research projects.

An Approach to Mixed Methods Research

Given the variety of mixed methods that are in current use, it will be helpful to describe the approach that will be used in the illustrative analysis of clinical data. This approach seeks to combine two methods (i.e., quantitative and qualitative) for addressing a clinical research problem without confusing them in ways that compromise their distinctive advantages. First, some broad features of quantitative and qualitative methods will be summarized. Then the two methods will be located in a broader spectrum of analytical methods used in clinical aging research. Finally, productive ways for integrating the two methods in a single research project will be described.

Conditioning and Contextualizing in Mixed Methods Research

Mixed methods research, broadly and simply defined, occurs when quantitative data analysis is combined with qualitative data analysis in the same or related studies. More specifically,

as conceived here, mixed methods research combines the quantitative conditioning techniques of statistical inference with the contextualizing methods of qualitative interviewing.

The primary analytical focus of clinical biomedical research is on assessing inferences regarding factors that put people at risk for disease outcomes and treatments that help them once they become sick. Inference in this context is usually statistical, involving conclusions about the study population on the basis of some numerical summary of an aspect of a sample drawn from that population, that is, on the basis of sample statistics. Statistical inference, informed by descriptive and graphical summaries of relevant numerical data, is the primary objective of quantitative data analysis. Central to this inferential process is conditioning of various sorts. For instance, regression modeling involves the estimation of outcome means or probabilities conditional on a set of explanatory and/ or predictive factors. Reporting a statistically significant association of a risk factor and disease outcome implicitly invokes the idea of conditional probability. A factor and an outcome are associated if the conditional probability of the outcome given the factor is not equal to the unconditional probability of the outcome.

A conception of qualitative data analysis emergent from biomedical research stipulates that it consists of the systematic coding and analysis of nonnumerical data, for example, verbal texts and visual images, for the purpose of developing taxonomies, themes, and theories for understanding the meanings of some topic of interest involving human beings (Bradley, Curry, & Devers, 2007). This conception does not encompass all valuable varieties of qualitative data analysis, even within the context of biomedical research, but it is applicable to many important qualitative studies, including the illustration provided for this article. Central to this variety of analysis are several types of contextualizing. On one level, qualitatively coded items of interest are located in systems of classificatory, predicative, and causal relationships. Practitioners of qualitative data analysis in the biomedical field have been fairly cautious about proposing causal theories, and in fact, new causal quantitative methods have yet to find wide application in biomedical research (Pearl, 2009); social scientists have been more ambitious in this regard and have developed some very sophisticated conceptual tools for causal theorizing (Ragin, 1987; Rihoux & Ragin, 2009). Contextualizing occurs on another level when, for instance, individual or focus group interview statements are placed in the broader psychological and social contexts that are difficult to capture with quantitative questionnaires.

One way in which the combination of the conditioning and contextualizing elements of mixed methods research can be conceptualized is by locating qualitative data analysis within the spectrum of statistical methods and describing the ways in which it contributes to the process of statistical inference. Of course, quantitative research might also be undertaken as a means to promote qualitative research; however, this is rarely the case in a biomedical context so the approach to mixed methods presented here will focus on qualitative contributions to the process of statistical inference.

Selected Design Options in Mixed Methods Research

Qualitative research might identify new variables for quantitative research that had not previously been conceptualized. Qualitative data analysis has also informed statistical inference by contributing to the development of measurement instruments used in quantitative studies. Participant interviews can guide researchers in identifying scale levels, phrasing variable questions, or developing experimental interventions that figure prominently in quantitative studies. Bradley has done work of this sort (Bradley et al., 2005; Bradley, Curry, et al., 2006; Bradley, Herrin, et al., 2006) as have some of the authors of this

article (Fried & Bradley, 2003; Fried et al., 2007). These studies provide examples of a sequential mixed methods design.

A second major type of design that has proved relevant to clinical biomedical research is a concurrent mixed methods design in which one type of analysis occurs embedded within the other. This is the design featured in the illustrative analysis to be introduced in this article. In this case, the qualitative study is embedded within a longitudinal, quantitative study. Qualitative results in these designs help researchers interpret the meanings of quantitative results and generate new quantitative hypotheses.

The literature on mixed methods describes many more types of designs than the two listed above, yet these two are sufficient for describing the spectrum of statistical methods shown in Figure 1. The path from qualitative methods to quantitative statistical inference in the upper-left part of the figure represents the sequential design, and the path from quantitative statistical inference to qualitative methods on the upper-right represents the concurrent design.

In addition to qualitative data analytic methods, the spectrum includes statistical simulation techniques. They are mentioned here because the intensely mathematical and computational character of simulation methods provides a sharp contrast to qualitative methods, thereby enriching the spectrum. Statistical simulation is the use of (pseudo-) random number generation for the purpose of investigating the properties of a probabilistic process. In recent decades, simulation techniques have become increasing common elements of data analysis, for example, bootstrapping for performing internal validation (Efron, 1983), multiple imputation for handling missing data (Rubin, 1987), and simulation extrapolation for addressing additive measurement error (Cook & Stefanski, 1994).

Qualitative, quantitative, and simulation methods are different methods that can be used to study the same research topic. When they provide evidence in support of the same conclusion, they can be said to validate the conclusion as obtained by any single method. The geometrical metaphor of triangulation is sometimes used to describe this multiple methods approach to validation (Denzin, 1978). The appeal to geometrical calculation, however, suggests a process that is overly precise. Rarely do these various methods yield results that could be said to converge to the same point as do the calculations of a land surveyor or a ship navigator. Especially in the matter of “mixing”—in how one integrates qualitative and quantitative elements of an analysis—caution should be exercised. The interpretive approach to data analysis recommended here sounds this note of caution while also providing principles for integrating different methods of analyzing the same subject matter.

Integrating Methods, Respecting Differences

An integrative approach to data analysis drawing on philosophical hermeneutics should not diminish respect for important differences in quantitative and qualitative methodologies. From the statistical point of view, the most crucial determinant of the types of “mixing” that are helpful in mixed methods research is the difference between the types of samples that qualitative and quantitative studies characteristically employ. Respectively, they are purposeful and random samples. A purposeful sample is collected to identify persons who have the knowledge to which researchers want to gain access. A random sample is collected to be representative of the population from which it is gathered so that inferences can be drawn from the sample to that population. A purposeful sample only needs to be as large as is necessary to obtain desired knowledge. When participants no longer add new information to the study—when “theoretical saturation” has been achieved for relevant coded categories (Strauss & Corbin, 1998)—then sampling can cease. A random sample needs to be

sufficiently large that sample statistics can be estimated with sufficient precision so that inferences can be made cogently to a relevant population.

Although the differences between purposeful and random samples are widely recognized, it is not always sufficiently respected in mixed methods theory and practice. Sample statistics should rarely be calculated for a qualitative purposeful sample because the purposefully sampled items are not drawn from a clearly identifiable population to which inferences can be drawn and because they fail to provide the statistical basis of independence and identical distributions that most inferential statistics require. One might argue that sample statistics can be regarded simply as descriptive summaries of the qualitative sample. There are two reasons why this rejoinder is not entirely adequate. First, such descriptive summaries are not very relevant to the task of qualitative research, which is usually directed toward individuals rather than groups. Second, in a way similar to how people experience a great temptation to bang on a drum to hear how it sounds, people are inclined to generalize a sample statistic to grasp its meaning. This is a temptation that should be resisted if unwarranted inferences are to be avoided. It is also doubtful that sound inferences can be drawn by merging most qualitative and quantitative data sets, for example, “by transforming the qualitative themes into counts and comparing these counts with descriptive quantitative data” (Creswell, 2009). Alternatives to sample statistics are available. For a study of 20 persons, instead of providing the proportion of males, simply provide the counts of males and females. Instead of giving mean ages for the 20 persons, provide a stem and leaf plot of the age distribution. On both statistical and hermeneutic grounds, an attribute table of quoted participants will be provided in the illustrative analysis in place of statistical summaries. From the statistical point of view, naively combining qualitative and quantitative samples or using statistical methods on qualitative samples are not productive ways to achieve the mixing promised by mixed methods.

More recently, proposals have been made recommending “purposeful random sampling” as a technique for giving “credibility” to mixed methods studies that employ it (Teddlie & Tashakkori, 2009). Because sampling cannot be entirely purposeful and random at the same time, it is not clear how such credibility can be attained. Neither a small purposeful sample from a large random sample nor a small random sample from a large purposeful sample provides a sound basis for statistical inference. Chance variation can make even small purely random samples very unrepresentative of the populations from which they are drawn. Also, drawing valid inferences from small samples often requires statistical techniques that are considerably more sophisticated than many researchers realize (Shih, Ohman-Strickland, & Lin, 2004). Given the obstacles to explicitly drawing statistical inference from small purposeful samples, one of the most productive ways to integrate qualitative information with quantitative data analysis in concurrent mixed methods research is to use the qualitative data as an interpretive resource for understanding the results of health condition measures and statistical measures of association.

Applications to Longitudinal Data Analysis

Caveats of the sort described above are even more important when study data are longitudinal. Statistical inference for longitudinal data is usually more complicated because dependency is often induced by the serial correlation of repeated measures. Qualitative studies with interviews gathered over time and with questions addressing memories or expectations are also more complicated. Thus, study designs for longitudinal mixed methods research should be chosen with care. Logical possibilities are at least threefold. One might gather qualitative information at each and every follow-up time that quantitative information is gathered. This fully longitudinal mixed design is potentially costly because of high demands on staff time and effort. Gathering qualitative information with this degree of intensity could have the unintended negative effect of overburdening participants so that

they fail to answer quantitative questions or answer them in unreflective ways. In this case, the qualitative study might actually introduce bias into statistical inferences.

Alternative designs might reserve the collection of qualitative data to the beginning or end of the process of gathering longitudinal quantitative data. This would yield prospective and retrospective longitudinal mixed designs that can be graphically portrayed as in Figure 2A and B.

The prospective design is most appropriate for investigating the expectations of participants regarding data that will be subsequently collected. The retrospective design is helpful for understanding how participants recollecting the experience regarding which quantitative data had been collected. A process of recollected changes in functional disability status will figure prominently in the mixed methods study that will next be used to illustrate an interpretive approach to mixed methods research.

An Illustrative Mixed Methods Analysis

In the qualitative substudy titled “Activities of Daily Living Among Older Persons” of the PEP longitudinal, quantitative study, a purposefully sampled group of 36 surviving study participants 80 years of age or older were interviewed in their homes for approximately 1 hour. They were asked to share experiences and opinions about their activities of daily living. Among several questions posed were the following:

> Think back over the time period since … {the 90-month interview date} … and think about your ability to do the following daily activities in order to take care of yourself: bathing, dressing, walking across a room, and transferring, such as in and out of bed. Here are some pictures showing how your ability to do these activities may have changed or not changed over this period. Which of these pictures comes closest to showing your ability to do these activities over the last year and one-half? Why did you choose this picture?

The pictures consisted of lines with upward slopes, for example, indicating increasing disability over time; downward slopes; zero slopes; and other graphical representations of change over time. Each of the participants had previously responded to serial monthly telephone interviews in which they were asked about their level of functional disability. Interviewers in the qualitative study had access to this quantitative data; the interviewers’ questions were mostly designed to elicit from participants a contextualized understanding of changes in their functional status.

One participant had the quantitative results summarized in Figure 3. The figure shows a relatively major episode of disability in March of 2007 in which the participant had disability in four activities of daily living. Gradual recovery occurred so that 2 months later no disabilities were reported. Later in the follow-up period, two episodes of mild disability (i.e., affecting only a single activity) were reported in the quantitative study. Part of their qualitative interview consisted of the following interchange:

> Interviewer: Can you recall back in December, just this past December around Christmas? Was there anything going on with you at that time that perhaps you required some help with one of these activities? Anything come to mind?
>
> Respondent 2,418: No, no.
>
> I: And how about just last month in April?
>
> R: About the same.
>
> I: The same being what?

R: Well when I get called by (the interviewer) I tell her I walk a block and I think well, I'm not getting better because I'm getting older, I'm real old [96] so I'm slower at everything and I don't shop. I take the trolley once in a while just to get out and to ride to Stop-n-Shop and then I can do only one aisle even with the walker; because it's big.

The interviewer was trying to draw the participant's attention to minor episodes of disability that occurred in December and April. The participant does not recall these episodes or chooses to assess them as experientially no different from the level of function occurring during the immediately prior months. How should this discrepancy be understood? One perspective might look on the participant's response as simply a case of inaccurate recollection. A previous study of the PEP sample has reported some level of inaccurate recall in approximately 50% of the study cohort (Gill, Van Ness, & Gahbauer, 2009). This perspective has legitimacy but the qualitative results here tell us something more. They allow us to interpret the evidence of what might be labeled "little recollection of disability" in a more nuanced way.

The Hermeneutic Circle

A common principle of philosophical hermeneutics is called the "hermeneutic circle" (Table 1). It postulates that while seeking to understand an object of interpretation, such as a poem or a sonata, one understands the parts in terms of the whole and, in turn, the whole in terms of the parts. Versions of this idea can be traced to Greek antiquity but it attains special prominence in the writings of the German philosopher and theologian Friedrich Schleiermacher (1768–1834), who is often credited with elevating hermeneutics beyond an amalgam of practical rules of interpretation to a broader philosophical viewpoint. He writes quite generally: "Complete knowledge always involves an apparent circle, that each part can be understood only out of the whole to which it belongs, and vice versa. All knowledge, which is scientific can be construed in this way" (Schleiermacher, 1805–1833/1978). Whether all scientific knowledge can be understood by means of this circle is not at issue here; however, this strategy of interpretation is helpful for the example of mixed methods research currently under review because the participants' recollections as recorded in the quantitative study and the qualitative study can be respectively viewed as parts and wholes. In this somewhat novel application of the hermeneutic circle, individual reports of disability during the monthly interviews can be seen as parts, which are comprehended in a holistic act of memory during the qualitative interviews occurring at the end of 18 months. From this vantage point, the discrepancy in quantitative and qualitative reports is not simply a matter of truth versus error, but it reveals a process of adaption in which over time a person sees minor episodes of disability as not much different from their usual functional experience as older persons. "I'm real old, so I'm slower at everything." Instead of revealing only inaccurate recall and the failing memory of an older person, the qualitative interview suggests that perhaps the retrospective grasp of disability experience is a psychologically helpful and healthy process of aging that adapts to adverse changes in a way that recognizes reality but also preserves a sense of relative well-being.

Figure 4 provides quantitative results for a second participant. These quantitative results show a modest increase in disability in the more recent past. The qualitative interview includes some sharply different evaluations of this experience of disability.

Interviewer: So for the past 18 months,

Respondent 205: I had no problem whatsoever.

I: You never required any help with bathing?

R: Just once.

****

R: But you know, these things {death} happen and I have had so damned many things wrong with me, carpal tunnel, had 2 knee operations, 2 shoulder operations. I'm frozen now. What do you call that now, in the neck?

And what's more I was supposed to go for a hip operation, I'm not going to go. That's it, I'm all done.

I: Done, you're all done?

R: Yeah, as far as operations, yeah, unless it's, unless I fall and I broke my neck or something.

The first lines of response show a similar deemphasizing of past disability experience as was evident in the previous respondent. Yet when the topic of death is raised in the interview, the respondent adopts a considerably more negative frame of mind. Context makes a difference. The statement "I'm frozen now" introduces a metaphor with many negative connotations, for example, rigidity, coldness, and decline. It suggests a hopelessness that is reflected in an unwillingness to cooperate with future treatment regimens such as a hip operation. This holistic recollection expresses unhappiness and recalcitrance that contribute to what might be labeled an "inconsistent recollection of disability."

No Interpretation Without Presuppositions

A second hermeneutic principle is relevant to comparing these two interview quotations. It posits that there is no interpretation without presuppositions. Again, this principle has a long lineage but it is especially associated with Wilhelm Dilthey (1833–1911), the German philosopher who, in contrast to Mill's positivism, formulated a conception of the human or social sciences ("Geistwissenschaften") whose research objectives and methodological practices differed sharply from those of the natural sciences. Understanding via interpretation and explanation of causal relationships, respectively, were characteristic of the two scientific approaches. For Dilthey, valid knowledge in the human sciences is such that, "In it the reality of external objects and other persons is presupposed, and that includes the presupposition that the empirical subject is determined by the milieu in which it lives (Dilthey, 1910/2002)." A modest application of this principle to the current mixed methods analysis recommends that to understand the interview excerpts quoted above it would be helpful to know key attributes of the persons speaking. An attribute table (Table 2) for quoted participants is thus a valuable supplement.

Included in this attribute table are basic sociodemographic information and other attributes that are deemed clinically important. One can note in the table that the participant who gave more consistent evidence of adaptation to functional disability status was also the older of the two, was female, and chose the picture for change in her status as one indicating gradual decline. These are relationships that have possible clinical interest. The availability of these variables suggests ways in which the contextualizing presented above could be complemented by a quantitative analysis involving conditioning. Because quantitative data on most of these attributes were collected in the parent study from which the qualitative participants were selected, it would be methodologically sound to explore the statistical associations between them in the complete data set. In the illustrative qualitative data analysis, these attributes promote the contextual understanding of qualitative themes such as older persons' adaptability to functional decline. A quantitative analysis of these attributes might reveal conditional relationships among them. Also, a future quantitative study, which included a variable for adaptability, might investigate associations between the key attributes and adaptability. The design of the mixed methods study from which this illustration is drawn did not, in fact, have this type of mixed methods analysis as a study

goal. Still, this proposed research direction illustrates possible productive interrelationships between qualitative and quantitative investigations of key participant attributes.

In this mainly methodological article, it has not been possible to offer a detailed analysis of how the participants' attributes inform the clinical meanings of the interview quotations. The point most relevant here is that an attribute table, such as Table 2, is more informative for the interpretive approach to mixed methods research than would be a statistical summary of the characteristics of the qualitative sample. The average age of the 36 persons interviewed is not as insightful as the age of persons quoted for understanding the content of what they are saying and how this qualitative material might provide insights regarding the corresponding quantitative results.

Not All Truth Is Methodical

A final hermeneutic principle was articulated in the late 20th century that qualified Dilthey's methodological ambitions for the human sciences. In his influential treatise *Truth and Method*, Hans-Georg Gadamer (1900–2002) wrote:

> The specific problem that the human sciences present to thought is one that has not rightly grasped their nature if one measures them by the yardstick of progressive knowledge of regularity. The experience of the sociohistorical world cannot be raised to a science by the inductive procedure of the natural sciences. (Gadamer, 1960/1989)

One way of appreciating this remark is to frankly acknowledge that even the most copious writings about mixed methods research—and this area of research has been characterized by an intense methodological self-consciousness—cannot ensure a greater degree of rigor and reproducibility for mixed methods analysis than its subject matter allows. Both qualitative analysis of interview data and quantitative analysis of numerical data have considerable uncertainty associated with them. A second lesson that might be drawn from this quotation arises from how Gadamer thinks that truth can be "rightly grasped" in the human sciences. Here, he follows the lead of Kant and much phenomenological philosophy in attending to factors that make understanding and interpretation possible. Rather than understand these factors in terms germane to Continental phenomenology—for example, in regard to the structure of the transcendental ego—mixed methods approaches to clinical biomedical research might more productively understand them in terms consistent with the empirical traditions of American pragmatism (James, 1907/2000). The factors that make understanding possible here are the practical interests and personal purposes that direct people's beliefs and that contribute to the criteria by which the practical consequences of beliefs and actions are assessed. Such interests and purposes, in our view, cannot be completely apprehended by inductive methods but require some degree of empathetic understanding. The implication of this hermeneutic principle is that contextualized follow-up questions in individual or group interviews are immensely important.

For example, after a respondent made some dramatic statements about being physically frozen and emotionally unwilling to undergo any more operations, the interviewer astutely inquired about the practical meanings and consequences of these statements.

> Interviewer: Have you needed to change your daily routine? And it sounds like it's a pretty busy daily routine. Have you changed?
>
> Respondent 205: Well, if I feel like going out, I go out. If somebody calls me up to do something and I could help them, I help them. I think I'm my own worse enemy because of the fact I never say no. I say ok I'll be there or yeah I'll do it. I'm one of those guys. I've been like that since I was on the fire department. My ability to help other people was always there.

A large part of this person's frustration with his physical disability was its obstructive impact on his ability to help others. This ability was important to his identity as a person and as a professional fireman; for him, helping others was a practical interest and personal purpose that was important for fully understanding his qualitative interview responses to questions about functional disability. By asking this follow-up question, the interviewer learns something very important about how changes in disability status over time affects a person's self-conception and frame of mind—something not at all evident in the earlier comments that sounded angry and uncooperative.

Conclusion

The case for a hermeneutic approach to the mixed methods data analysis in clinical biomedical research has now been made. It has consisted of both cautionary and prescriptive elements. Given the centrality of statistical inference in biomedical research, great caution has been recommended regarding any introduction of qualitative elements that might undermine the validity of statistical inference. So calculating statistics on purposeful cohorts, combining counts from qualitative and quantitative data sets, and collecting small "purposeful random" samples have all been discouraged. Instead, recommendations have been made to use results from qualitative data analysis to formulate new hypotheses for quantitative research and to interpret more adequately the measurement instruments, summary statistics, and measures of associations that figure prominently in quantitative data analysis.

The prescriptive case has recommended the use of several hermeneutic principles in the design and conduct of some mixed methods studies and especially in such studies involving longitudinal data.

Thus, the hermeneutic circle was invoked to recommend prospective and retrospective study designs in which repeated quantitative measurements are collected along with qualitative interviews that reflect on this experience as a whole. The interplay of part and whole can then be used to attain a more subtle understanding of the participant's experience than could be obtained by simple opposition of truth to error. A second hermeneutic principle posited that there is no interpretation without presuppositions; this principle was cited to recommend the presentation of an attribute table of the quoted interview participants. These attributes can reveal some personal and circumstantial factors that provide the context for interview statements in a way that is more individual and applicable than purposeful sample statistics. Finally, a hermeneutic stricture about the limits of inductive methods emphasizes the importance of contextualized follow-up questions in interviews that seek to empathetically understand the practical interests and personal purposes that inform what participants say about their present and past experiences.

The illustrative mixed methods analysis does not itself justify conclusions regarding the process of adaption in which an individual over time perceives minor episodes of disability as not much different from their usual functional experience as older persons. This adaptive process suggests that perhaps the retrospective grasp of disability experience is a psychologically helpful and healthy process of aging, in which an individual adapts to adverse changes in a way that recognizes reality but also preserves a sense of relative well-being. The analysis has, however, contributed to the formulation of a hypothesis that might be investigated in future confirmatory studies.

The most novel feature of the mixed methods analysis of longitudinal gerontologic data presented in this article consists of the way in which the analysis draws on basic hermeneutic principles to both inform and justify the integration of quantitative and

qualitative elements of the analysis and to guide practical choices regarding study design, conduct, and presentation. An especially promising area for the application of this mixed methods approach is clinical aging research wherein aging encompasses both processes of physiological change across the life span and experiences of personal change over time having psychological, social, and even spiritual dimensions.

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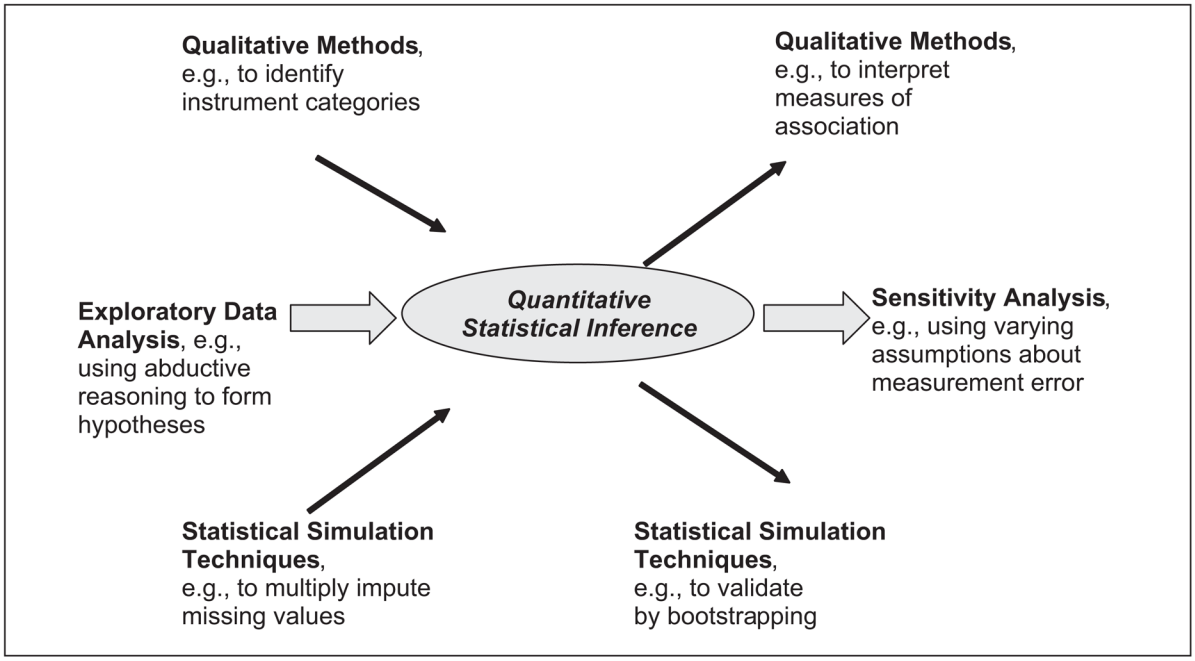

Figure 1.
A spectrum of statistical methods

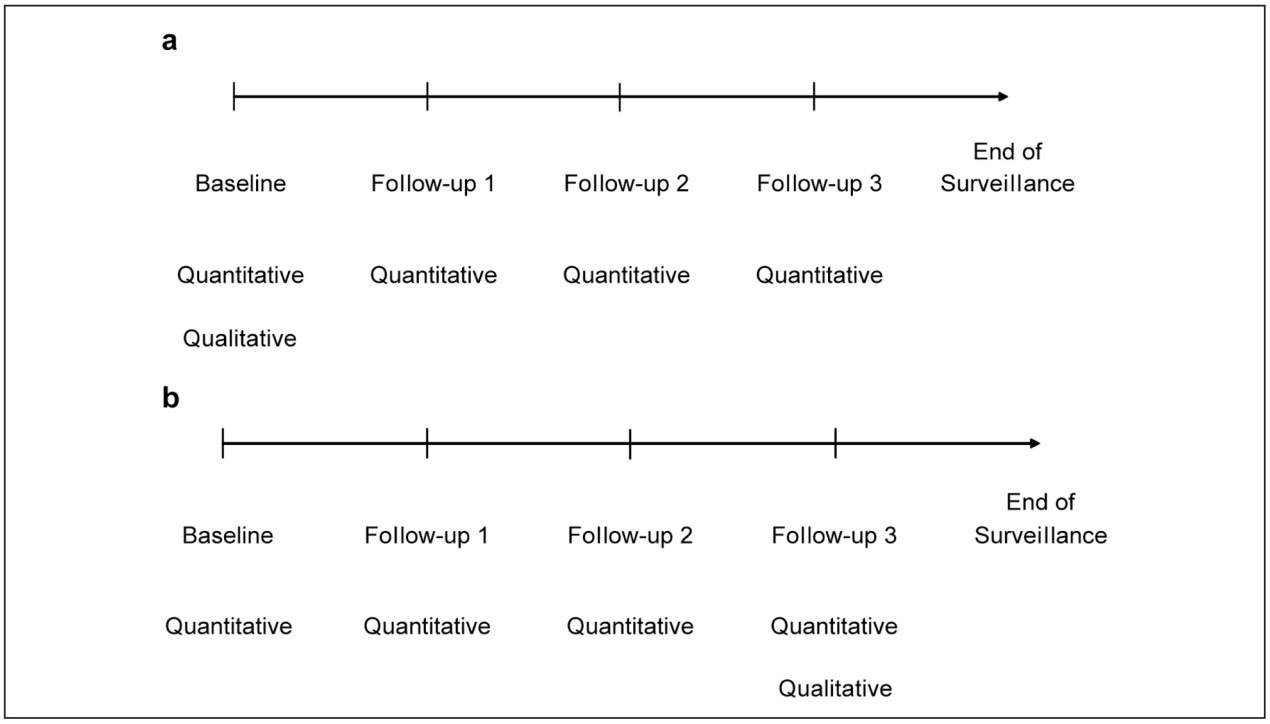

Figure 2.
(A) A prospective longitudinal mixed methods design. (B) A retrospective longitudinal mixed methods design

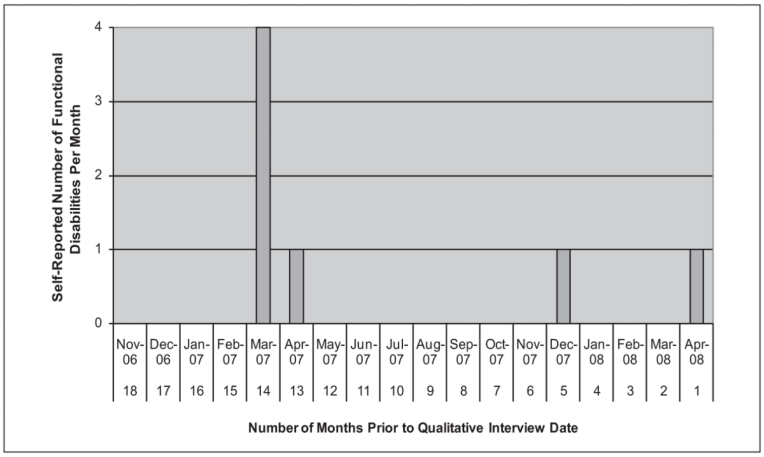

Figure 3.
Chart of quantitative data for Study Participant 2,418 with “little recollection of disability” in a retrospective interview

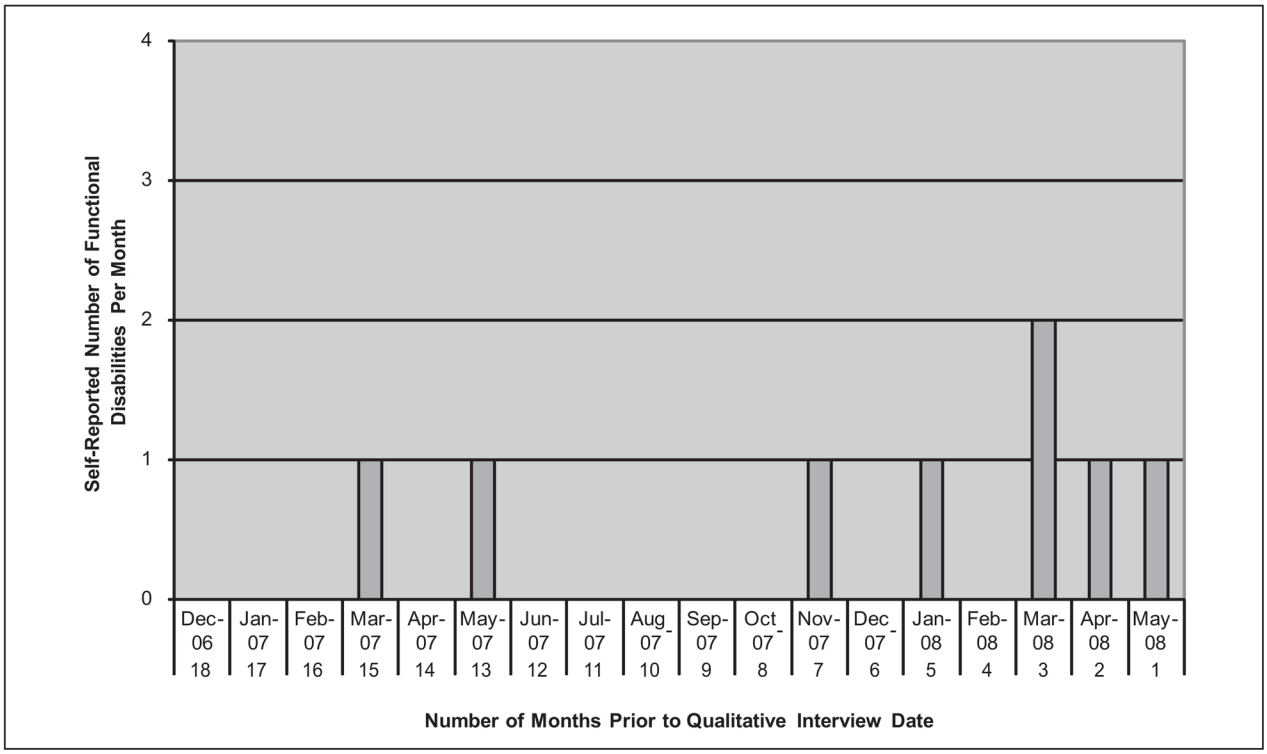

Figure 4.
Chart of quantitative data for Study Participant 205 with “inconsistent recollection of disability” in a retrospective interview

Table 1

The Impact of a Hermeneutic Approach on Mixed Methods Research Involving Longitudinal Data

Hermeneutic Principle	Study Aspect	Practical Impact
Hermeneutic circle: One should interpret a whole in terms of its parts, and parts in terms of the whole to which it belongs.	Design	Prospective or retrospective relation of qualitative interviews to longitudinal quantitative data[a]
Empathetic understanding: Application of methods should be combined with sensitivity to individual interests and purposes.	Interview	Contextualized follow-up questions regarding practical interests and personal purposes[b]
Presuppositions for interpretation: Attention should be given to study participant attributes and related factors that inform interview responses.	Presentation	Attribute table of quoted study participants including summary measures of change over time[c]

[a] For the textual illustration of this principle, see the section titled “The Hermeneutic Circle.”

[b] For the textual illustration of this principle, see the section titled “Not All Truth Is Methodical.”

[c] For the textual illustration of this principle, see the section titled “No Interpretation Without Presuppositions.”

Table 2

Attribute Table for Quoted Qualitative Study Participants

Study ID	Age (in Years)	Gender	Race	High School Education	Housing Status	Picture of ADL Change
0205	<85	Male	White	No	House	Missing
2418	≥85	Female	White	Yes	Age-restricted housing	Gradual decline

Note: ADL = activities of daily living.