

Developing the DESCARTE Model: The Design of Case Study Research in Health Care

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Abstract

Case study is a long-established research tradition which predates the recent surge in mixed-methods research. Although a myriad of nuanced definitions of case study exist, seminal case study authors agree that the use of multiple data sources typify this research approach. The expansive case study literature demonstrates a lack of clarity and guidance in designing and reporting this approach to research. Informed by two reviews of the current health care literature, we posit that methodological description in case studies principally focuses on description of case study typology, which impedes the construction of methodologically clear and rigorous case studies. We draw from the case study and mixed-methods literature to develop the DESCARTE model as an innovative approach to the design, conduct, and reporting of case studies in health care. We examine how case study fits within the overall enterprise of qualitatively driven mixed-methods research, and the potential strengths of the model are considered.

Keywords

case studies, health care, mixed-methods, research design, methodology, qualitative

The appeal of case study in health care research is clearly evident and has grown in recent years (Antony & Jack, 2009; Hyett, Kenny, & Dickson-Swift, 2014). Case study offers a flexible research approach to enable a holistic, in-depth, multiple perspective examination of the phenomena of health and illness within real-life contexts (Abma & Stake, 2014; Walshe, Caress, Chew-Graham, & Todd, 2004). Case study provides a cogent approach by which to examine the complexity of health care systems (Anaf, Drummond, & Sheppard, 2007) and has been advocated as a means to understand the context of randomized controlled trials of complex interventions (Wells, Williams, Treweek, Coyle, & Taylor, 2012). It can also offer a flexible and pragmatic research approach in real-life clinical settings such as palliative care where experimental research designs can either be unethical or unfeasible to implement (Payne, Field, Rolls, Hawker, & Kerr, 2007). However, a recent review draws attention to inconsistencies in the use of case study in health care (Hyett et al., 2014). We begin this article by providing a brief overview of case study research approaches commonly used in health care. Next, we highlight additional perceived deficiencies in the conduct and reporting of case study research and critically reflect on the causes and consequences of this within health care research. Finally, we seek to mitigate against this by drawing from

the case study and mixed-methods literature to develop the DESCARTE (**DES**ign of **CAS**e **RE**search in **healTh**-**carE**) model as novel approach to enhance design, conduct, and reporting of case studies in health care.

Case Study Research in Health Care

Defining Case Study Research

The large array of textbooks on case study from anthropological, sociological, educational, political, and applied social sciences reflects its long and rich history within these disciplines (George & Bennett, 2005; Gerring, 2007; Merriam, 1988; Ragin, 1987; Rohlfsing, 2012; Simons, 2009; Stake, 1995, 2006; Thomas, 2011a). A comparable disciplinary textbook from health care is conspicuous in its absence although notable contributions to the literature from health care researchers such as Sandelowski (1996, 2011) and Walshe (2011; Walshe

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Table 1. Definitions of Case Study.

Definition	Author
"...the intensive study (however) accomplished of one or more cases for some explicit purpose"	Sandelowski (2011, p. 154)
"Case study is not a methodological choice but a choice of what is to be studied . . . By whatever methods we choose to study the case"	Stake (2005, p. 443)
"Case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a 'real life' context."	Simons (2009, p. 18)
"A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident."	Yin (2009, p. 18)
"A case study is an intensive, holistic description and analysis of a single instance, phenomenon or social unit."	Merriam (1988, p. 16)

et al., 2004) are recognized. Several definitions of case study exist, with commonly cited definitions illustrated in Table 1. These nuanced definitions indicate that case study can be defined in terms of *the case itself* (the unit of study), *the case study design* (the process), and *the case study* (the product) (Antony & Jack, 2009; Walshe, 2011).

Case study research does not ascribe to a fixed philosophical perspective, methodology, or method. However, the desire to obtain an in-depth multi-perspective holistic enquiry about the phenomena of interest means that multiple data sources typify this research approach. Although not characterized by mixed-methods per se, mixed-methods are often used within case study research in health care and when used, they are generally qualitatively driven.

Case Study Typologies

Several typologies of case study are described in the literature (George & Bennett, 2005; Stake, 1995, 2005; Thomas, 2011b; Yin, 2009) with Yin and Stake's typologies most commonly cited. Yin's (2009) typology principally describes three types of case study as descriptive, exploratory, and explanatory. Yin proposes that case studies can be additionally classified according to two attributes, first whether they are single or multiple cases and second, whether a single or multiple "unit of analysis" applies. However, ambiguity exists as to what the term the "unit of analysis" means (Grunbaum, 2007). Yin posits somewhat contradictory accounts of its meaning even within the same text first indicating "your tentative definition of the unit of analysis (is the same as the definition of the 'case')" (p. 30), yet he later ascribes the term to describe either different sampling units of data or units of inquiry (p. 50). Whereas Miles and Huberman (1994) and Patton (2002) argue that the case and the unit of analysis are synonymous.

Stake (2006) proffers an alternative view, he describes the case as specific entity which must first be understood

after which a phenomenon or function of the case can be studied. Stake's (1995, 2005) typology describes three types of case study as intrinsic, instrumental, and collective. An intrinsic case study seeks to develop a comprehensive understanding of a particular case for its own value whereas an instrumental case study seeks to provide insight into a wider issue or to theoretically refine a theoretical explanation. Collective (multiple) case studies seek to explore how single cases can be "meaningful" to other cases when they share a common characteristic or condition or are examples of a phenomenon (Stake, 2006). In collective case studies, Stake (2006) uses the term *quintain* as an overarching term to describe an object, phenomenon, or condition to be studied. He stresses that in a multiple case study, the focus of inquiry shifts from an understanding of the singular case to an understanding of the quintain. Thus, typological classifications of case studies derived from Yin (2009) and Stake (1995, 2005, 2006) are primarily determined by sample characteristics and the purpose of the research.

Data Analysis in Case Study

Yin (2009) argues that data analysis is the least developed aspect of case study research and asserts "there are few fixed formulas or cookbook recipes to guide the novice" (p. 127) and proffers four analytical techniques of pattern matching, explanation building, time series, and program logic models. Yin's description of an iterative cycle of explanation building closely resembles analytical induction; however, in his description, the hypothesis is formulated a priori and not inductively from initial case analysis. Other than explanation building, the remaining three data analysis techniques appear grounded in a positivist approach with techniques described in terms such as pattern matching of dependent variables to strengthen validity or multiple experiments. Yin briefly mentions a fifth analytical technique of cross-case synthesis using

Table 2. Studies Included in the Rapid Review.

Journal	Articles Included
<i>The International Journal of Nursing Studies</i>	E. Maxwell, Baillie, Rickard, and McLaren (2013); Mitchell, Parker, and Giles (2013); Padgett (2013); Procter, Wilson, Brooks, and Kendall (2013); Unbeck et al. (2013)
<i>Journal of Clinical Nursing</i>	Bowskill, Timmons, and James (2013); Houghton, Casey, Shaw, and Murphy (2013); Keady et al. (2013); Kilpatrick (2013); Marshall, West, and Aitken (2013); Tobiano, Chaboyer, and McMurray (2013)
<i>Journal of Advanced Nursing</i>	Begley et al. (2013); Callery, Kyle, Banks, Ewing, and Kirk (2013); De Rouck and Leys (2013); Elliott et al. (2013); Gerrish, McDonnell, and Kennedy (2013); Moore and Prentice (2013); Noyes, Lewis, Bennett, Widdas, and Brombley (2013); Powell (2013); Williams, Burton, and Rycroft-Malone (2013)

tabular displays but this method of analysis is poorly described. In contrast, Miles and Huberman's (1994) classic qualitative textbook contains detailed chapters providing prescriptive guidance on conducting within-case and cross-case data analysis using data displays, causal networks, matrices, meta-matrices, and scatter plots which seek to produce verifiable findings grounded in a realist approach. Saliently, their writings draw attention to the distinction between case-based and variable-based approaches to data analysis (Ragin, 1987). Case-based analysis uses holistic case-level data derived from within-case analysis whereas variable-based approaches seek to correlate relationships between variables contained in each case (Byrne & Ragin, 2009). Stake (1995, 2006) adopts a naturalistic constructivist approach to data analysis drawing from a "palette of methods" within qualitative inquiry (Stake, 1995, pp. xi-xii). Stake (1995, 2006) argues that although no single data analysis approach prevails within case study, stages of data analysis proceed by description, categorical aggregation, pattern matching, and naturalistic generalization to produce meaning and interpretation which is emic from the case and context dependent to enable holistic understanding of the case (Abma & Stake, 2014).

Critiquing the Design and Reporting of Case Studies in Health Care

Despite the plethora of texts on case study design, qualitative case studies reported in the health care literature have been critiqued for omitting detailed methodological description (Hyett et al., 2014; Taylor, 2013). Hyett et al.'s (2014) systematic review of 34 qualitative case studies from three qualitative health care journals demonstrated limited description of the case study design in a significant number of studies with inconsistencies in paradigmatic approach, methodology, and study design evident. Currently, it is uncertain whether perceptions of poor methodological reporting extend to the wider practice of

case study research in health care, including case studies using a mixed-method approach. To provide a "snapshot" of the conduct and reporting on a wide range of case study design, we performed a rapid review of case study from an area of the contemporary health care literature. Given that case study is becoming an increasingly popular research approach in nursing, we chose to examine 1 year of publications in three nursing journals: *The International Journal of Nursing Studies*, *Journal of Clinical Nursing*, and *Journal of Advanced Nursing*. We searched the abstracts of these journals for the year 2013 using the search term *case stud**. This yielded 26 articles of which 20 were original research articles reporting the findings of a case study. The remaining 6 articles presented a narrative review (Dewinter, Vermeiren, Vanwesenbeeck, & Nieuwenhuizen, 2013), a scoping review (Gonzalez & Kirkevold, 2013), and a protocol (St Ledger et al., 2013) while 3 articles reflected on the literature and illustrative findings from existing case studies to propose new conceptual or theoretical frameworks (Borbasi, Galvin, Adams, Todres, & Farrelly, 2013; Kilpatrick, Lavoie-Tremblay, Lamothe, Ritchie, & Doran, 2013; Van Der Zande, Baart, & Vosman, 2013). The 20 studies included in our rapid review are listed in Table 2.

We reviewed these 20 articles and extracted data on the following:

- Was an informing philosophical approach described?
- How was the case study design described?
- How was the method of data analysis described?

Explicit reference to an underpinning philosophical approach was poor with only six articles stating a philosophical approach: constructivism (Powell, 2013), critical ethnography (Padgett, 2013), critical realism (E. Maxwell, Baillie, Rickard, & McLaren, 2013), realist (Noyes, Lewis, Bennett, Widdas, & Brombley, 2013; Williams, Burton, & Rycroft-Malone, 2013), and whole systems approaches (Procter, Wilson, Brooks, & Kendall, 2013). Explicit reference to a philosophical approach in

mixed-method and case study research is crucial to inform judgment about the methodological robustness and findings of the research.

The majority of articles cited an informing case study author and their ascribed typological classification. Yin was cited in 12 articles and Stake in 3 articles. Four articles cited a variety of informing case study authors and 1 cited none. Six articles reported on single case studies with the remaining 14 articles reporting multiple case studies. Case definition was often implied rather than explicitly defined and only 7 articles described explicit case definitions (Begley et al., 2013; Bowskill, Timmons, & James, 2013; Gerrish, McDonnell, & Kennedy, 2013; Kilpatrick, 2013; E. Maxwell et al., 2013; Moore & Prentice, 2013; Noyes et al., 2013) while 1 article described two different case definitions (Elliott et al., 2013). Three authors used single data sources; De Rouck and Leys (2013) and Gerrish et al. (2013) used interviews only while Keady et al. (2013) used case summaries. The remaining authors used a variety of multiple data sources, although only Begley et al. (2013); Callery, Kyle, Banks, Ewing, and Kirk (2013); Mitchell, Parker, and Giles (2013); Unbeck et al. (2013); and Williams et al. (2013) explicitly identified their research as mixed-methods studies. No authors used mixed-method notation (Morse, 1991; Polit & Beck, 2012) or a schematic of case study design (Miles & Huberman, 1994; Rosenberg & Yates, 2007).

The purpose of multiple data sources and data integration was explicitly discussed in the methods section in only seven articles, and only E. Maxwell et al. (2013) provided a detailed explanatory account which was clearly linked to the informing philosophical approach. Triangulation was cited as a means to reduce respondent bias (Mitchell et al., 2013), improve rigor (Tobiano, Chaboyer, & McMurray, 2013), and for completeness (Callery et al., 2013). Multiple data sources and data integration were cited by Moore and Prentice (2013) to improve credibility and by Williams et al. (2013) for construct validity. Begley et al. (2013) made reference to the strengths of triangulation between qualitative and quantitative data within the limitations sections only. This indicates limited consideration of the justification for multiple data sources and mixed-method integration in the current literature.

The quality of reporting of data analysis procedures was variable; Padgett (2013) did not describe data analysis while Noyes et al. (2013) described analysis as “difficult to explain” (p. 230). In particular, in articles reporting multiple case studies, data analysis procedures were opaque and there was often insufficient clarity of data analysis procedures to enable study replication. Several factors contributed to this. First, as highlighted earlier, definitional attributes of cases were poorly

described and thus it was difficult to clearly ascertain what within-case analysis and cross-case analysis actually pertained to. Second, in several instances, it was not explicit whether data analysis procedures pertained to within-case or cross-case analysis or whether analysis procedures applied to whole data sets (Begley et al., 2013; Bowskill et al., 2013; Houghton, Casey, Shaw, & Murphy, 2013; E. Maxwell et al., 2013; Powell, 2013). Begley et al. (2013) appear to use a variable-based approach to data analysis but this is not clearly articulated. Marshall, West, and Aitken (2013) describe using “multiple case study analysis” (p. 1424) but report findings which “examine data at the individual participant level” (p. 1427).

In studies using multiple data sources, description of integration of data analysis was variable. Unbeck et al. (2013) and Callery et al. (2013) present and integrate data analysis within the findings of the results section. Similarly, Begley et al. (2013) integrate the findings of qualitative and quantitative data analysis within the results section; however, the authors do not make it explicit how qualitative data from observations, interviews, and documentary evidence were integrated during qualitative data analysis. Houghton et al. (2013) and Williams et al. (2013) provide appropriate description of methods informed from Miles and Huberman (1994) to integrate data analysis. In contrast, E. Maxwell et al. (2013), Kilpatrick et al. (2013), and Elliott et al. (2013) provide limited description of how they used analytical frameworks or matrices to integrate and analyze multiple data sources. Finally, several authors did not clearly discern when applying the same method of data analysis to a range of different data sources (e.g., non-participant observation, semi-structured interviews, and so on) if this was applied to all raw data sources simultaneously or whether data sources were analyzed individually with subsequent integration of data analyses (Bowskill et al., 2013; Marshall et al., 2013; Mitchell et al., 2013; Moore & Prentice, 2013; Procter et al., 2013).

In summary, although nearly all the articles cited an informing case study author(s), only a minority of articles clearly described their philosophical and methodological approach and significant variability in the quality of the reporting of data analysis procedures existed.

Informed from the findings of our rapid review and Hyett et al.’s (2014) earlier systematic review, we speculate that researchers might be lured into a false sense of methodological security by declaring their allegiance to one case study author and their respective typologies without giving sufficient consideration to the underpinning philosophical and methodological approach to study design and methods used. We hazard that such practices contribute to the unstructured and insufficiently detailed descriptions of case study design evident.

Moreover, the apparent acceptance of poor methodological reporting of case study brings into question how the rigor of case study is currently judged within the peer review process. The EQUATOR (Enhancing the QUALity and Transparency Of health Research) network (n.d.) advocates the use of robust structured reporting guidelines to improve the reliability and value of published health care research literature. However, the use of such guidelines to inform the quality of research articles is a contentious issue with proponents (Altman, 2015) and challengers of their use (Sandelowski, 2015). Although guidelines on the reporting of clinical case reports are available (Gagnier et al., 2014), none exist for case study research, further risking inadequate reporting.

As indicated earlier, case study offers a flexible and valuable research approach in health care. Moreover, it can provide meaningful examination of the multidimensional experience of health and illness, concurrently experienced within micro-, meso-, and macrosystems (Mason, 2006) while accommodating complexity theory to enable study of systems within health care (Anderson, Crabtree, Steele, & McDaniel, 2005). However, case study (specifically) and qualitatively driven methods (more generally) are perceived as less valuable within the hierarchy of health care research evidence (Evans, 2003). We believe that the poor reporting of case study design (as evidenced in our review) risks amplifying these perceptions of the limited worth of case study which may further deter its use.

To mitigate against these concerns, we have drawn from the case study and mixed-methods literature to develop the DESCARTE model as novel approach to enhance design, conduct, and reporting of case studies within health care. While accepting recent advances in causal data analysis approaches in case study from the social and political sciences (Rihoux & Ragin, 2009; Rohlfing, 2012), we agree with Yin (2009) that data analysis in case study remains underdeveloped. Given that most case studies use multiple and often mixed data sources, we believed that the mixed-methods literature would provide fruitful insight to develop our model. Finally, we examine how case study fits within the overall enterprise of mixed-method research and the potential strengths of the model are considered.

Introducing the DESCARTE Model

The DESCARTE model encompasses three sequential stages in case study research:

- Stage 1: Situating the research and the researcher
- Stage 2: Determining the components of the case study design
- Stage 3: Data analysis—adopting the three stances

The model is presented in Figure 1 and delineates the case (the unit of study), the case study design (the process), and the case study (the product).

Twelve Questions to Guide Researchers Using the DESCARTE Model

To facilitate the use of this model in practice, we have framed 12 questions to guide researchers. The 12 questions are listed in Table 3.

We now describe the three stages of the DESCARTE model and discuss the relevant literature informing its design and indicate at the end of each stage how these 12 questions are applied.

Stage 1: Situating the Research and the Researcher

We posit that at the outset of the case study, researchers should explicitly state their informing philosophical approach, their positioning of “self,” and the ethical dimensions of the research. Accepting that each of these constructs is inexorably linked, the salience of each is now presented. The inability to ascribe a fixed philosophical perspective to case study has been acknowledged in the case study literature. Luck, Jackson, and Usher (2006) assert that case study is a “paradigmatic bridge” which is not assigned to any ontological, epistemological, or methodological position. Sandelowski (2011), however, considers that the concept of a bridge is less useful, arguing that it is not a prerequisite of case studies to bridge the paradigmatic divide to be considered case studies. However, qualitative purists would refute any need for a paradigmatic bridge given that the incommensurability of paradigms means that the “accommodation between paradigms is impossible” (Guba, 1990, p. 81). Appealing to a pragmatic perspective, Howe (1988) contests the *incompatibility thesis* of mixing quantitative and qualitative methods arguing that research methods cannot be assumed to have fixed one-way ontological or epistemological commitments (p. 10) and that philosophical thinking has advanced beyond the “moribund positivist-interpretivist split” (p. 15). Such contrasting philosophical viewpoints are held by case study authors; Yin (2009) would appear to support the view that case study research should be located within an appropriate governing paradigm whereas Rosenberg and Yates (2007) assert that case study research is pragmatic and “selects the methodological position most suited to answer the particular question” (p. 448).

Yet debate about philosophical positioning seems seldom considered by authors in the practice of case study research. This we believe is somewhat puzzling given that case study is typified by the use of multiple and often

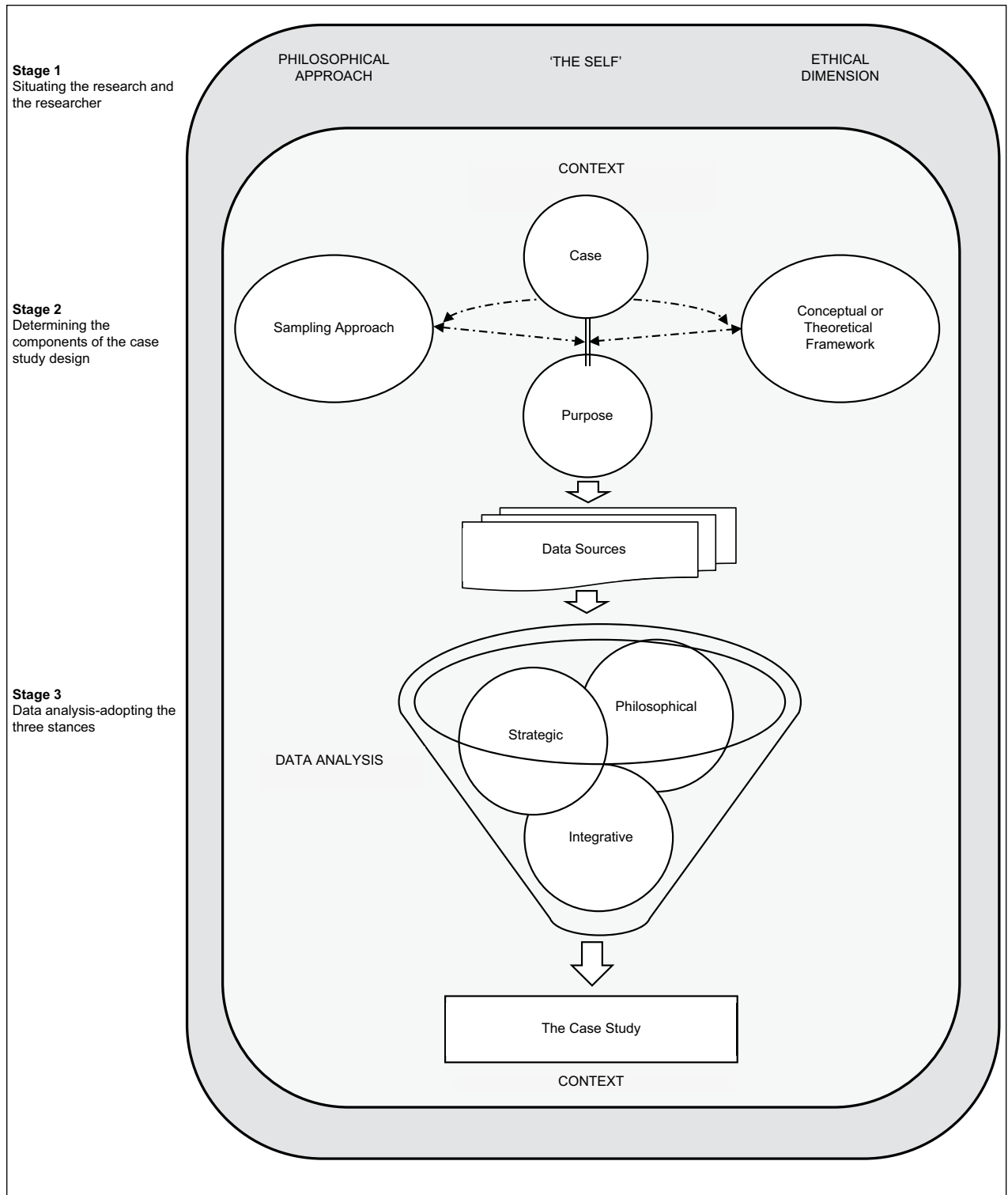


Figure 1. The DESCARTE model of case study research.
 Note. DESCARTE = **DES**ign of **CA**se **R**esearch in heal**Th**car**E**.

mixed qualitative and quantitative data. In contrast, within the mixed-methods literature, there is lively debate about “paradigm pluralism” with mixed-methods researchers

using a variety of philosophical approaches including pragmatism, critical realism (J. A. Maxwell & Mittapalli, 2010), the dialectical stance (Greene, 2007), and the

Table 3. Twelve Questions to Guide Researchers Using the DESCARTE Model.

Stages of the DESCARTE Model	Guiding Questions for Researchers
Situating the research and the researcher	1. What is my philosophical approach? 2. How do I situate my “self” in this research? 3. What are the ethical dimensions of this research?
Determining the components of the case study design	4. How is the case defined? 5. How is context defined? 6. What is the purpose of the case study? 7. What is the conceptual/theoretical framework for the case study? 8. What is my sampling approach? 9. What is the rationale for my choice of data sources?
Data analysis—Adopting the three stances	10. Is data analysis congruent with the philosophical approach? 11. Is my analysis adopting a case-based or a variable analysis-based approach? 12. How and why is data integrated during data analysis and interpretation?

Note. DESCARTE = **DES**ign of **CA**se **R**esearch in **healTh**car**E**.

transformative paradigm (Mertens, Bledsoe, Sullivan, & Wilson, 2010; Teddlie & Tashakkori, 2012, p. 779).

We believe that a similar debate is critical within case study. Researchers must acknowledge these philosophical tensions and explicitly declare their underpinning philosophical approach. The need for philosophical clarity is to enable coherence at the level of design, analysis, and interpretation, such that studies are coherently realist or relativist, or if leaps between these stances occur, that this is explicitly discussed. The need for this is considerable with mixed-method case studies where philosophical paradigms informing the choice of methods might clash. Failure to be explicit weakens the quality of a study and can undermine the legitimacy of findings (Collins, Onwuegbuzie, & Johnson, 2012). Furthermore, as Collins et al. (2012) argue, lack of philosophical clarity can adversely affect how researchers balance views between emic (insider) and etic (outsider) views to understand the phenomenon of interest. We believe that this is particularly salient for mixed-method case studies informed from a dialectical approach presenting emic and etic perspectives (Greene, 2012).

Researchers must also explicitly consider how their ontological beliefs will inform how multiple perspectives are presented within case studies. Ribbens McCarthy, Holland, and Gillies (2003) debate that this is seldom considered in case study and propose three alternative approaches of an “objectivist” or “interpretationist” or “bird’s eye view” (p. 1) to present multiple perspectives. Gabb (2009) is one of a small number of researchers who clearly illustrated her ontological position in her mixed mixed-methods case study where she describes her refusal to present a “sanitised” single objectivist reality, but rather aimed to “to retain the experiential loose ends that characterise lived lives” (p. 44).

The positioning of “the self” presents specific challenges within case and mixed-methods studies and is interwoven with the philosophical approach adopted by

researchers. Daly (2007) argues that our positioning of the self is “contingent on our epistemological beliefs” (p. 192) and their role in knowledge production. In mixed-methods, the positioning of self and reflexive practices are often only considered with regard to the qualitative component of a mixed-method study (Brannen, 2005) although O’Cathian, Murphy, and Nicholl (2008) contend that reflexive practices can apply to both qualitative and quantitative components of a mixed-method study. However, Greene (2012) goes further and argues that the “self-in-inquiry” is a critical issue in all research, intertwined with both epistemological and ontological assumptions and should be considered “across all methodological divides” (p. 756).

Nias (1993) distinguishes between the “substantial self” and the context dependent “situational self.” Two salient challenges can emerge for the situational self in production of knowledge for health care case study researchers. First, if mixed-methods are used, researchers must be mindful of differences in their situational self with respect to their positioning as a researcher who might possess differing preferences (or indeed have preferences imposed on them by external funders) and competences in qualitative or quantitative methods. Second, health care researchers might have a dual research/clinical role and must therefore be attentive of possible differences in their situational selves in different relational contexts within a multi-perspective case study, for example, if a clinician researcher is interviewing a variety of different participants including health care managers, clinical peers, patients, or family members. This may affect data collected and have implications for subsequent knowledge production and findings of the study.

Guillemin and Gillam (2004) argue that reflexivity goes beyond critically reflecting on the process and product of knowledge construction asserting that it should be used to anticipate and respond to ethical dilemmas in research. Case study research also presents additional

ethical considerations where researchers must balance a sufficiently detailed description of context and rich narrative voice of participants without risking anonymity.

Damianakis and Woodford (2012) critically reflect on how they used reflexive practices to uphold ethical standards when conducting their case study research with useful insights obtained for future research practice.

While the constructs of the philosophical approach, the self and ethical dimensions are considered at the outset of Stage 1 of the DESCARTE model, figure 1 clearly illustrates that Stages 2 and 3 remain embedded within these three primary constructs; thus researchers must be attentive to these three primary constructs throughout the case study research design. In this first stage of the DESCARTE model “situating the research and the researcher,” we have aligned with Crotty (1998) believing that first stage of research design *should* begin with consideration of broad philosophical assumptions. However, some case study researchers prioritize the research question above philosophical positioning arguing that philosophical and methodological positioning is contingent on the most suitable way to answer the research question. However, we argue that researchers believing the primacy of the research question within the worldview of pragmatism, by this very action, have already begun to situate themselves philosophically even if the philosophical positioning of their research later shifts in the subsequent enactment of the design of their case study. As highlighted earlier, the embedding of Stage 2 and Stage 3 within these primary constructs can thus accommodate case study researchers adopting such a pragmatic approach. The first three questions have been framed to guide researchers during Stage 1.

Stage 2: Determining the Components of the Case Study Design

Case study does not use a unique or prescriptive methodological approach but rather is methodologically flexible. The *methodological eclecticism* of mixed-methods is similarly flexible with researchers selecting and integrating techniques from a range of qualitative, quantitative, and mixed approaches to study the phenomenon of interest (Teddlie & Tashakkori, 2012). Current typological classifications of case study provide no directive guidance on either methodology or method although we acknowledge that typological designs derived from the mixed-methods literature can be used to convey the design of case studies using Morse’s (1991) notation (Polit & Beck, 2012). However, agreeing with critics who argue that typological classifications of mixed-method design can be too reductive to express the complexity of potential combinations of study design (Guest, 2013;

J. A. Maxwell & Loomis, 2003), we sought out alternative models of mixed-method design to inform our approach to case study. Hall and Howard’s (2008) synergistic mixed-methods model adopts a dialectical approach to facilitate multiple viewpoints on the phenomena of interest. Their model is based on the concept of the equal value of qualitative and quantitative methods within a study. Given that case studies using a mixed-method approach in health care are generally qualitatively driven, we felt that application of this model to case study was thus limited.

Following J. A. Maxwell and Loomis’s (2003) interactive model of mixed-method design, we propose four critical components in case study design: the case, the purpose, the sampling approach, and the conceptual or theoretical framework. Unlike J. A. Maxwell and Loomis’s model which has the research question as the central component, we propose that the central component is the “case-purpose dyad,” while acknowledging that any research questions for the study would derive from this case-purpose dyad and be mediated by the conceptual or theoretical framework. We have assigned the case-purpose dyad as the central component for two reasons. First, as Stake (2006) argues, case study is “particularistic” and centers on the understanding of a particular case in a particular context, thus, the case must be considered as a central component of research design. Although we recognize that in collective or multiple case studies the focus of inquiry shifts to Stake’s understanding of quintain, this understanding is only achieved by examination of particular cases. Second, it emphasizes that the purpose of the case study is in inexorably linked with the choice of case(s).

Ascribing the case-purpose dyad as the pivotal design consideration proffers an advantage by making redundant adherence to prescribed typological descriptions of case studies and an array of confusing terminology that exists within case study. Rather than propagate the use of confusing terms such as unit of analysis, we assert that clarity within the design of case study would be afforded by simply providing an explicit definition of the case-purpose dyad. We believe that it is vital that researchers clearly determine at the outset of their research whether they are defining their case as “phenomenon,” for example, the experience of care, or as an “entity,” for example, a person, family, ward, hospital, service provider. This delineation is crucial in study design; it impacts on how cases are bound, how context is defined, how data sources are justified, and the conduct of data analysis. We suggest that adopting this approach provides clarity in delineation of case and contextual factors and would inform the rationale for the choice of data sources. It would provide clarity in data analysis approaches as it is evident that unless the case and purpose are clearly defined, subsequent data

analysis strategies invoking terms such as within-case and cross-case analysis are meaningless. It is important to highlight that the temporal dimension of context must be considered to indicate whether the design is retrospective, cross-sectional, or longitudinal. These factors are critical in determining how case study research findings are obtained, presented, and interpreted within studies.

The exact sequencing of the choice of case, context, and purpose may vary for different case studies. For example, if the research design simply seeks to describe a case for its intrinsic interest, then we think it reasonable to assert that the first two questions of “How is the case defined?” and “How is context defined?” have been addressed *de facto*. Alternatively, it could be argued that the purpose of the case study should be considered first. Sandelowski (2011) draws attention to this in her discussion about the process of “casing” whereby cases are constructed by researchers dependent on the focus and purpose of the research although acknowledging that cases may be “discovered” by researchers informed by a realist perspective. We think that proffering case-purpose dyad as a linked component further emphasizes the interdependency of case and purpose but allows flexibility to accommodate both realist and constructivist approaches to casing.

Drawing from J. A. Maxwell and Loomis’s (2003) and Thomas’s (2011a) writings on mixed-methods and case study, we consider that two other salient interdependent components should feature within this interactive design, namely, the “conceptual or theoretical framework” and the “sampling approach” adopted. Researchers should examine pre-existing literature and theory and clearly outline whether the research seeks to test theory, construct new theory or contribute to existing theory and whether a deductive, inductive, or abductive approach will be used. We acknowledge that the use of a conceptual framework might not feature in all case study research if the purpose is simply to describe or illustrate a phenomenon of interest. A plethora of texts on sampling approaches in case study and mixed-methods are available (Curtis, Gesler, Smith, & Washburn, 2000; Miles & Huberman, 1994; Onwuegbuzie & Collins, 2007; Seawright & Gerring, 2008; Yin, 2009). While accepting the diversity of sampling approaches available, it is apparent that any given approach is inevitably informed by the case-purpose dyad and the conceptual or theoretical framework. Thus, any approach adopted must be clearly derived with regard to these two interdependent components. These components of study design will inform the choice of data sources which can include an array of qualitative and quantitative data.

The interdependence of these critical components of research design is illustrated in Stage 2 of the DESCARTE model in Figure 1. Six questions have been framed to

guide researchers during Stage 2. As highlighted earlier, the exact sequencing of the first five questions framed to assist researchers during Stage 2 do not necessarily need to be prescriptively ordered as currently listed in Table 3. However, addressing all five questions followed by a final question of “What is the rationale for my choice of data sources?” during Stage 2 will ensure that a cohesive and coherent design will be developed.

Stage 3: Data Analysis and Adopting the Three Stances

We propose that three stances must be adopted by researchers in their method of data analysis; we describe these stances as philosophical, strategic, and integrative. The overlapping representation of these stances within the DESCARTE model (Figure 1) illustrates that these stances are considered concurrently rather than linearly. The philosophical stance means that researchers must clearly articulate how their method of data analysis is congruent with their philosophical approach outlined during Stage 1. As highlighted earlier, we acknowledge the interwoven nature of positioning of self and philosophical approach and stress that researchers must work reflexively during data analysis to consider how their ontological and epistemological beliefs affect knowledge production.

The strategic stance means that researchers must provide an explicit statement about the strategy used in their approach to data analysis. This is of particular relevance to multiple case studies. Multiple case studies must clearly state whether a case-based or variable-based analysis approach (Byrne & Ragin, 2009) or indeed, whether a combined approach is used (Miles & Huberman, 1994). These choices should be justified and the implications of this considered. Researchers using case-based analysis approaches must clearly describe the strategy to within-case and cross-case analysis including what analytical approaches are adopted and the chronology of analyses. This may include two distinct analytical approaches. For example, in their case study of patients’ constructions of disability in metastatic spinal cord compression, Eva, Paley, Miller, and Wee (2009) clearly describe their strategic stance as,

Within-case analysis was informed by George and Bennett’s account of process tracing, and between-case analysis was modelled on the constant comparative method of Glaser and Strauss. (p. 133)

Finally, regardless of whichever preferred method of data analysis is adopted, researchers must declare their integrative stance; by this, we mean researchers must clearly outline how they will integrate data analysis. Case

study seeks to provide a multi-perspective holistic examination of the phenomena of inquiry; however, we believe that it is not readily apparent in many case studies exactly how data is integrated to achieve this aim. Bazeley (2010) makes the following reflection on data integration in mixed-methods:

Integration can be said to occur to the extent that different data elements and various strategies for analysis of those elements are combined throughout a study in such a way as to become interdependent in reaching a common theoretical or research goal, thereby producing findings that are greater than the sum of the parts. (p. 432)

We think that the goal of data integration in case study should be similarly considered. Moreover, we think that integration of data in case study must be described in a sufficiently detailed and transparent way to inform judgments about the quality of the study and to enable replication of the study. This is imperative given the array of different data sources used within case study.

Although data analysis in the mixed-methods literature can be conveyed with typological description, we agree with Guest's (2013) assertions that adherence to prescriptive typologies fail to reflect the "complexity and iterative" nature of the research. Instead, Guest suggests that description of data analysis should center on the timing of integration and the purpose of integration of data and their relationship at each stage of the research process. Following Guest, we believe that a similar approach should be adopted within case study, whereby in outlining their integrative stance, researchers must include in their description of data analysis a statement about the timing and purpose of data integration.

Guest (2013) suggests that timing of integration of data should be described for each stage of the process to include data collection, data analysis, and interpretation. Saliently, he describes these in terms of the chronological interface of data sets, for example, concurrent, sequential, and so on, but also whether one data set is transformed into data of another type (conversion). Researchers who have collected qualitative and quantitative data in their case study must, for example, consider whether the quantitative data are retained or whether these data are qualitified (Sandelowski, 2000; Tashakkori & Teddlie, 1998). Researchers must outline why data have been transformed and consider the implications of doing so.

Drawing from the mixed-methods literature the purpose of data integration can be justified using Greene, Caracelli, and Graham's (1989) terms of triangulation, complementarity, development, initiation, and expansion or using Bryman's (2006) 16 justifications. Although prospectively considering the purpose of data integration, researchers must be mindful that findings can be

produced in unanticipated ways (Bryman, 2006). This draws attention to the importance of using reflexive practices to acknowledge that justification of the purpose of data integration can also occur retrospectively. Completion of data analysis and interpretation of the findings will result in the case study as a product of the research. The model illustrates how the case (the focus of research) and the case study (the product of the research) acknowledge the influence of context. Questions 10 to 12 have been framed to guide researchers during Stage 3.

We believe that application of the three stances of data analysis (philosophical, strategic, and integrative) will enable researchers to provide a transparent and coherent description of data analysis that while respecting the diversity of design permutations available within case study, will ensure that a sufficiently detailed account of data analysis is presented. We think that this expansive approach is expedient to maintain the tradition of flexibility in data analysis approaches without necessarily prescribing fixed categories of strategies to data integration.

However, we accept that some case study researchers may prefer to consider strategies for data integration within more established groupings, such as the five groups described by Bazeley (2012). First, those that integrate results from analyses of separate data components. Second, those that integrate multiple data components or sources *during* the process of analysis; this includes comparative methods using matrices commonly used in case study. Third, those where the data invite integration of more than one strategy for analysis; this includes approaches such as qualitizing or quantizing data. Fourth, those whose methods are "inherently mixed." This includes causal analysis approaches such as process tracing (George & Bennett, 2005; Rohlfsing, 2012) and qualitative comparative analysis (Ragin, 1987; Rihoux & Ragin, 2009; Rohlfsing, 2012) commonly used in case studies in political sciences, but used infrequently in health care (Donnelly & Wiechula, 2013). We believe Bazeley's (2012) remaining grouping of those where one form of data informs the design or analysis of another is perhaps less relevant in the context of most case study research in health care.

Nonetheless, agreeing with J. A. Maxwell and Loomis (2003) that "uncovering the actual integration of qualitative and quantitative approaches in any particular study is a considerably more complex undertaking than simply classifying the study" (p. 256) we think that researchers must go beyond simply classifying their data analysis strategies. We believe that using the three stances of data analysis within the DESCARTE model will help researchers do this and will enable them to clearly "uncover" their approach for others to see.

Conclusion

Considering case study and mixed-methods research as separate entities is a false dichotomy. Rather we argue that the boundary between case study and mixed-methods should be considered permeable and fluid to enable case study to fit within the overall enterprise of mixed-methods but conversely to also enable mixed-methods to fit within the enterprise of case study. Continued adherence to the sole use of the language of either case study or mixed-methods typologies should be rejected, as neither adequately conveys the complexity of case study design. We believe that the DESCARTE model provides a comprehensive yet flexible model of case study design. Positioning the case-purpose dyad as the central focus of the model enables the particularistic nature of case study to be clearly discernible without applying the restrictive labeling of current case study typologies. We contend that with the rapid advancement of the use of case study research in health care, we must conceive new models to inform our approach to case study design to negotiate these mutually shared boundaries and propose the DESCARTE model as an innovative approach to case study design.

We do not present the DESCARTE model as a reductive model of case study design but rather as an inclusive model to help researchers design and present their case study design accessibly, coherently, and transparently. Although the three stages of our design model are common to more established models, the strength of the DESCARTE model lies in the attentive and expanded description within each of the three design stages. In particular, “data analysis,” readily acknowledged as the least well-developed aspect of case study research (Simons, 2009; Yin, 2009) is a focal component of the model. The questions accompanying the model are not presented as a checklist but are included to help researchers use our model. Although we have focused discussion within the landscape of predominately, qualitatively driven mixed-method case studies prevalent in health care research, we believe that the model is also applicable within multi-method qualitative case study and quantitatively driven mixed-method case studies. We consider that the use of the model would confer additional benefits. We believe that asking researchers to explicitly attend to their paradigmatic stance, positioning of self, and ethical dimensions of the case study will ensure that the practice of qualitatively driven mixed-methods case studies remains firmly rooted in the qualitative tradition. We think that it would be expedient for the model to be used as template to facilitate the generation of a schematic of case study design (Rosenberg & Yates, 2007) to be used in the reporting of research articles. Finally, as discussed earlier, the apparent acceptance of poor methodological

reporting of case study brings into question how the rigor of case study is currently judged within the peer review process. We consider that this model could act as a stimulus to develop new standards by which to judge the methodological robustness of case study.

Although the prevalence of case study in the health care literature is increasing, it is readily apparent that there is a paucity of insightful texts on how to design and conduct case study within the dedicated health care arena. The practice of research is an organic and experiential process and requires engagement with the wider community of practice. The development of the DESCARTE model evolved during the design of a qualitatively driven mixed-methods case study on the experience of emotional distress in families in palliative care. The use of the model has undoubtedly helped structure our approach to the design of the current case study, and upon completion of the study, we will be able to reflect upon its utility in practice. As Denscombe (2008) argues, the process of acquiring knowledge occurs through participation in groups and adoption of shared practices. We believe that meaningful debate about the practice of case study within the community of health care research is critical to advance knowledge and practice of this valuable research approach. We hope that our proposed model will provide a stimulus to further this necessary debate.

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