Applying mixed methods research to a cost-benefit analysis

Lyn Murphy

School of Accounting and Management, Manukau Institute of Technology, Auckland, New Zealand

lyn.murphy@manukau.ac.nz

Dr William Maguire

School of Accounting and Corporate Governance, University of Tasmania, Tasmania, Australia

william.maguire@utas.edu.au
Applying mixed methods research to a cost-benefit analysis

ABSTRACT

A significant challenge to management researchers is to find ways to use both quantitative and qualitative methods to understand research problems better. The expectation is that a mix of qualitative and quantitative methods is likely to enhance information beyond that produced by either method independently. This paper illustrates research design choices and how they are made in a current research project. The research design in this instance incorporates mixed method, mixed methodology and equal dominance to analyse the costs and benefits of conducting sponsored clinical drug trials in a publicly funded hospital.

Keywords: mixed methods, multilevel methods, research paradigms, triangulation, research design innovations

This paper illustrates research design choices and how they are made in a current research project. It provides an overview of mixed methods research highlighting worldview, methodology, research design and method. For the purposes of this paper, we define the above terms as follows: (1) a worldview is a belief about what knowledge is and how it is constructed (Morgan 2007); (2) methodology is an ‘analysis of the assumptions, principles, and procedures in a particular approach to inquiry’ (Schwandt 2001 p161). (3) research design is a ‘procedure for collecting, analysing, interpreting and reporting data in research studies’ (Creswell and Plano Clark 2007 p58) and (4) methods are the tools and techniques used to gather data.

The aim of the clinical trials cost benefit analysis (CTCBA) referred to in this paper is an analysis of the costs and benefits of conducting sponsored clinical trials in a publicly-funded hospital. The costs and benefits related to these trials involve a range of stake-holders and several layers of analysis. The method that is most appropriate for each of these layers differs according to the stakeholders concerned. Underlying the aim or research question are seven specific objectives. The first five objectives are to establish the costs and benefits of sponsored clinical drug trials as perceived by:

1. participants involved in clinical trials;
2. management and the multidisciplinary team;
3. the larger South Auckland community;
4. government and decision makers; and
5. pharmaceutical companies.

The sixth objective is to establish the cost and benefit of sponsored clinical drug trials to:

6. the Centre for Clinical Research and Effective Practice (CCRep) and Counties Manukau District Health Board (CMDHB).

The seventh objective seeks to bring the above six objectives together by identifying:

7. The similarities and differences that exist across these levels of analysis.

**WORLDVIEW**

Historically researchers have opted for either a positivist worldview, associated with quantitative methods or a constructivist worldview associated with qualitative methods (Doyle, Brady and Byrne 2009). Positivist versus constructivist debates abound in the literature (Bryman 2007). While purists argue that positivism and constructivism cannot be combined (Smith and Heshusius 1986, Lincoln and Guba 2000) others suggest that these worldviews exist on a continuum and that claimed distinctions are less obvious under scrutiny (Bryman 2001, Brannen 2005). Writers have recently referred to an alternative worldview, pragmatism (Tashakkori and Teddlie 2003, Morgan 2006, Creswell and Plano Clark 2007). Using a pragmatic worldview the practical consequences are considered. As the CTCBA is both problem centred and practice oriented a pragmatic worldview is appropriate. The pragmatic researcher uses what Morgan (2007) calls abductive reasoning which refers to the way in which the researcher moves between inductive and deductive reasoning. With abductive reasoning ‘the inductive results from a qualitative approach can serve as inputs to the deductive goals of a quantitative approach, and vice versa’ (Morgan 2006 p72). The pragmatic researcher also moves between subjectivity and objectivity which Morgan labels ‘intersubjectivity’. Morgan argues that it is impossible to act in a state of ‘complete objectivity’, that it is equally hard to establish a state of ‘complete subjectivity’, so therefore the researcher should move freely along the objectivity – subjectivity continuum. We regard this freely flowing thinking to be a beneficial to the CTCBA, because the quantitative data analysis requires a degree of objectivity while at the same time the qualitative analysis requires a greater amount of subjectivity, the researchers therefore
need to move freely along the objectivity – subjectivity continuum. The combined use of qualitative and quantitative methodologies is compatible with a pragmatic worldview and thus the preferred choice for the CTCBA. The next issue is the choice of methodology, which we discuss in the next section.

THE METHODOLOGY

Methodology provides justification for the methods of a research project (Carter and Little 2007 p1318). Researchers have traditionally chosen between qualitative or quantitative methodologies. Qualitative research is a methodology that derives from constructivism and uses inductive reasoning to understand the meanings individuals give to phenomena (McGivern 2006). Qualitative studies draw on a number of methods including focus groups, in-depth interviews, and observation to obtain detailed, context-rich findings that are usually presented in words, matrices and pictures (McGivern 2006, Curry, Nembhard and Bradley 2009). Researchers ask open-ended questions to help gain an in-depth understanding of a single idea or phenomenon (Creswell and Plano Clark 2007).

In contrast, quantitative research applies a positivist worldview to statistically test hypotheses in experimental and natural settings (Curry, Nembhard and Bradley 2009). Quantitative research methods include a range of techniques that are used to gather measurable data of a quantity and quality to support empirical analysis using statistical methods (Anderson and Widener 2007) and may include surveys and interviews in which closed questions are asked of participants to assess specific variables (Creswell and Plano Clark 2007). The findings are presented as numbers, percentages and means in charts and graphs (McGivern 2006).

Increasingly mixed methods research is being used as an alternative to using a single quantitative or qualitative methodology. Creswell and Plano Clark (2007 p5) define mixed methods research as:

\[
\text{a research design with philosophical assumptions as well as methods of enquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases of the research process. As a method, it focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of}
\]

\[\text{...}\]
quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone.

Greene, Caracelli & Graham (1989) present five possible advantages of using mixed methods research: (1) initiation—discovering fresh perspectives through paradoxes and apparent contradictions; (2) triangulation—testing the convergence or validity of results; (3) complementarity—elaboration, enhancement, illustration and clarification of results; (4) development—using the results from the first methods to inform, design and implement the second method; and (5) expansion—extending the breadth or scope of the project. Initiation, triangulation, complementarity and expansion were considered important as a means of contributing breadth and depth to the CTCBA.

Creswell and Plano Clark (2007) identify four situations in which mixed methods research should be the preferred research methodology. These include when: (1) either a quantitative or qualitative study is inadequate in itself to address the research problem; (2) there is a need to enhance a study with an additional source of data, i.e. a quantitative study enhances a qualitative study or a qualitative study enhances a quantitative study; (3) there is a need to explain the quantitative results; and (4) there is a need to explore qualitatively before undertaking a quantitative study.

Although we initially considered a single approach for the CTCBA we rejected it because neither a qualitative nor a quantitative methodology used individually is likely to answer our research questions. The complex nature of the health industry may explain the increasing tendency to use mixed methods research in health management research. Freyens (2008 p830) describes the health industry thus:

This industry has long-faced intrinsic input problems (skill shortages and high technology cost of some services) and demand problems (expenditure is demand driven and therefore hard to control). Outputs are hard to measure (good health outcomes appear less related to health services than income) and consist of a large array of medical and health services, hospital and nursing care, subsidised pharmaceutical products, health research, health insurance etc.
Twinn (2003) suggests that mixed methods research allows the complex questions frequently asked in this industry to be addressed. With complex intertwining issues surrounding the costs and benefits to a number of stakeholder groups (trial participants, caregivers, researchers, staff, pharmaceutical companies and government decision makers), mixed methods research is a practical choice for the CTCBA. A second reason for the increased use of mixed methods research in the health industry is given by Giddings (2006) who asserts mixed methods research is attracting more research funding as increasingly, collaborative research projects with nursing, medical and paramedical professionals using a variety of methods is being encouraged by funding bodies. With medicine traditionally associated with quantitative research and nursing with qualitative research, the interdisciplinary research team can utilise the strengths of mixed methods research (Doyle, Brady and Byrne 2009).

Mixed methods research also meets the needs of multiple and diverse stakeholders for a project including those who need hard data for their decision-making and those who wish to understand better the feelings of the participants. Greene (2005 p209) observes mixed methods research: ‘offers greater possibilities than a single method approach for responding to decision-makers agenda, as well as to the interests of other legitimate stakeholders’. This quality was influential in the choice of design for the CTCBA as although politicians require quantitative information to guide their allocation of health care resources other stakeholders including patient groups may not place the same importance on financial metrics. Mixed methods research has emerged as an appropriate methodology for the CTCBA. The next step is the research design.

THE RESEARCH DESIGN

A research design provides a strategy or blueprint specifying the methods and procedures used for collecting and analysing data. The idea of mixing research methods is relatively recent, though the number of designs incorporating mixed methods research is growing (see for example; Cresswell 2003, DePoy and Gitlin 1994, Morgan 1997). There are three key decisions a researcher makes when designing a mixed methods study (Creswell and Plano Clark 2007). These decisions are illustrated in figure 1. The
first decision is the timing decision, which is based on the timing of the stages, and whether qualitative and quantitative approaches are to be used concurrently or sequentially (Creswell and Plano Clark 2007).

**Figure 1: Decisions Tree for mixed method design based on Creswell 2003. Source: Doyle, Brady and Byrne (2009).**

Following a review of 48 mixed methods research studies O’Cathain, Murphy and Nicholl (2007) found that within the field of health research sixty percent of studies were sequential. We nevertheless choose a concurrent design for the CTCBA to allow for corroboration of the qualitative results with the quantitative findings. Using a concurrent design costs and benefits identified in the quantitative phase can be further explored in the qualitative phase and vice versa. This two way interaction is not possible in a sequential design which completes one phase before the other is begun.

The second decision in mixed methods research design is the weighting decision, which focuses on the status of qualitative versus quantitative methods. How the weighting is determined and what the weightings are has strong design and resource implications. The weighting influences the complexity and
sophistication of the procedure used for each method (Creswell and Plano Clark 2007). If both methods have equal weighting the study will require more resources (Creswell 2003). There are a number of interpretations available on when, where and how quantitative and qualitative phases should be weighted with each other. Possibilities include weighting phases according to their division in the research design, the time taken to undertake each phase, the quantity of data generated by each phase or the relative importance given to each type of result (Hall and Howard 2008). The interpretation adopted for the CTCBA is the priority or relative importance given to each phase in answering the research questions (Morgan 1998, Cresswell and Plano Clark 2007). In a mixed method study the qualitative and quantitative phases can have equal priority or one phase can have higher priority over the other. The CTCBA gives equal priority to both phases as both qualitative and quantitative phases are equally valued and therefore regarded just as important in addressing the research questions.

The third decision is the mixing decision which determines how the Quantitative and qualitative sets of data will be explicitly related. Unless the two data sets are mixed the research will simply be one of multiple methods and not true mixed methods research (Creswell and Plano Clark 2007). Creswell and Plano Clark (2007) suggest three mixing options: (1) Merging - the joining together at the final interpretation or analysis stage of both sets of data to form a combined set of data. This normally occurs at the final interpretation or analysis stage. (2) Embedding - when one set of data is used to answer the primary question and the second set of data is used to answer a lesser secondary question within the study. Embedding begins early in the research design stage and produces results which show both data sets. (3) Connecting - when conducting one phase identifies a need for collecting another type of data. Mixing occurs between phases as the two data sets are connected. The connection between the data sets is explored in the final analysis. The CTCBA merges the data in the interpretation stage of the study specifically when objective seven is addressed. This is consistent with the previous design choice of equally weighting the data sets. This is in contrast to embedding and connecting which are more closely linked to a single dominant weighted design.
Principles or values can guide the choice of research design. Three key principles developed by Hall and Howard (2008) influence the choice of design for the CTCBA. These principles are: (1) that qualitative and quantitative methods interact so that their combined effect is greater than the sum of their individual effects. This means that when mixed methods research is applied to the CTCBA more information is expected to be produced than either qualitative or quantitative research will do if used independently. (2) that equal value is placed on the outcomes of the qualitative and the quantitative methods. When applied to the CTCBA this means that neither approach is valued more highly than the other. (3) that paradigmatic differences are protected while choosing the methods that provide the greatest opportunities within the research design. There are some research questions in the CTCBA that are better suited to a qualitative approach (research objectives 1-5) while objective 6 is best answered using a quantitative approach and objective 7 is a mixed research question which brings the study together.

Creswell and Plano Clark (2007) developed typology of mixed method designs that identifies four types of design: (1) triangulation, (2) embedded, (3) explanatory and (4) exploratory. These design choices are shown in figure 2. Starting at the left side of figure 2 is triangulation which occurs when the qualitative and quantitative paradigms are given equal weighting and are used concurrently. The term “triangulation” can be confusing in mixed-method research as it can refer either to data collection procedures or to research design (Tucci 2007). The triangulation design of mixed method research brings together the strengths of both quantitative and qualitative methods allowing results to be compared. It allows the reviewing and analysing of evidence from multiple sources as a base for a study’s findings (Erlandson, Harris, Skipper and Allen 1993) and provides opportunities to confirm or corroborate the qualitative results with the quantitative findings (Creswell and Plano Clark 2007). Triangulation is the most frequently used design (Doyle, Brady and Byrne 2009).

The far left of figure 2 shows four models of triangulation design: (1) the convergence model where integration occurs during the interpretation phase (2) the data transformation model where quantitative and qualitative data are collected concurrently before being transformed either by quantifying the qualitative data or by qualifying the quantitative results. (3) the quantitative model, where qualitative
techniques are added to a quantitative and benefit study such as the adding of open ended questions at the end of a survey (4) the multi-level model is when the focus of the study is on a system and different methods are used to address the different levels within the system.

Figure 2: Creswell and Plano Clark’s typology of mixed method research design Source: Doyle, Brady and Byrne (2009).

Moving to the right in figure 2 the second type of design - the embedded design is shown. This design has one dominant data set with the other data set providing a secondary or supportive role (Doyle, Brady and Byrne 2009). When priority is given to the quantitative data, and the qualitative data set is subservient the researcher is using an embedded experimental model. In contrast, when the qualitative data is dominant and the quantitative data is added to help explain the outcomes the research is called an embedded correlational model. The selection of an embedded design may be influenced by the skills and experience of the researcher or by the research goals. Alternatively the selection may be influenced
the target audience, for example if a study's target audience is unaccustomed to or unaccepting of either a qualitative or quantitative paradigm then their preferred paradigm can be given greater weighting (Creswell and Plano Clark 2007).

The third design type towards the top right of figure 2 is the explanatory design. This design consists of two sequential phases, beginning with the quantitative phase and then the qualitative phase, which aims to explain or enhance the quantitative results (Creswell and Plano Clark 2007). There are two models of explanatory design: (1) the follow-up explanatory model, where the researcher uses qualitative techniques to explain specific quantitative findings, such as unexpected results, outliers or differences between groups (2) the participant selection model where the quantitative phase is initially used to identify and purposefully select participants for a follow-up in depth qualitative study (Doyle, Brady and Byrne 2009).

Moving to the top far right of figure 2 the exploratory design is found. Using the exploratory design the first phase, qualitative, helps in the development of the quantitative phase. Again there are two models for an exploratory design: (1) the instrument development model design which is used for developing and testing quantitative instruments based on their qualitative results (2) the taxonomy developmental model which is used when the qualitative element is used for developing a taxonomy or it is used to develop an emerging theory and then the quantitative element provides more detail to the qualitative results.

The design most suited to the CTCBA is a multi-level research model variation of the triangulation design. Doyle, Brady and Byrne describe the use of a multi-level model:

> The multi-level research model variation of the triangulation design is used when the focus of the study is on a system and different methods are used to address the different levels. For example, qualitative methodology may be used to ascertain the views of nurse managers on a particular issue, and this is compared with a survey of staff nurses’ views (2009 p 181).

The CTCBA uses a multi-level model as the costs and benefits related to the trials involve a range of stake-holders (trial participants, caregivers, researchers, staff, pharmaceutical companies and government decision makers), and several layers of analysis. Because each method reveals different aspects of empirical reality, mixtures of methods are employed. The design for the CTCBA is illustrated in figure 3.
Figure 3: Overview of research design

1. Initial research problem
2. Develop Methodology
3. Identify Worldview
4. Study design and method
5. Collect and analyse qualitative data
   - Focus groups
   - Semi-structured interviews
   - Surveys
6. Collect quantitative data
   - Results from case matched study
   - Accounting data
   - Survey responses
7. Thematic analysis of focus groups and interviews using deductive reasoning
8. Analyse quantitative data using deductive reasoning
9. Analyse qualitative data together: Stage 1A triangulation
10. Analyse quantitative and relevant qualitative data together. Stage 1B triangulation
11. Draw quantitative conclusions
    - Construct quantified CBA
12. Synthesize outcomes of analyses using inductive reasoning. Stage 2 triangulation
13. Evaluate progress
14. Draw some tentative conclusions
15. Further evaluate literature on emergent themes
The design uses triangulation at two levels: first, triangulation occurs when a number of qualitative methods are used to gather data, which are then analysed together; second, triangulation occurs when quantitative data are analysed with qualitative data. It is adapted from a successful design used by Johnstone (2004) to explore the adoption of new surgical technology in a health-care setting. The types of questions that Johnstone addresses are sufficiently similar to those of this study to warrant the adaption of her design.

The research process begins with the identification of a broad research problem, which is translated into a number of research questions (cell 1). The identification of research worldview (cell 2) and the development of the methodology (cell 3) occur next as described previously in this section. This influences the development of the study design and method selection (cell 4), which provides a guide (cells 5 to 16) for the interactive, circular process of data collection, data analysis, and design review that follows until saturation is reached and no new information emerges (Lincoln and Gubra 1985). The data are analysed using inductive and/or deductive reasoning (cells 7, 8 and 12). A qualitative phase is then used to gather information from a number of participant groups. The mixed method allows for a wide range of data to be considered and therefore provides opportunities for triangulation (cells 9, 10 and 12) involving the reviewing and analysing of evidence from multiple sources (Cresswell 1994). The qualitative and quantitative data are merged to provide an analysis of the research problem at multiple levels. Finally, conclusions are reached using the merged data and a cost benefit analysis constructed for the quantitative (cell 8) and qualitative (cell 16) data. Table 1 shows the specific objectives, data collection methods and participants of the study.

**METHODS**

Research methods include the research activities of: (1) sampling, (2) data collection, (3) data management, (4) data analysis, and (5) reporting (Carter and Little 2007). Mixed methods research uses a combination of qualitative and quantitative research methods. This may mean one or several methods representing each research approach. In well designed mixed methods research the specific research
Table 1: Specific objectives, research methods and participants of CTCBA study

<table>
<thead>
<tr>
<th>Specific objective</th>
<th>Method</th>
<th>Participants</th>
</tr>
</thead>
</table>
| Objective 1: To establish the cost and benefit of clinical drug trials as perceived by participants involved in clinical trials. | Focus groups  
Individually surveys   | Purposive sampling will draw from two hundred and fifty two participants who were enrolled in either the ADVANCE or ON TARGET CCRep studies |
| Objective 2: To establish the cost and benefit of clinical drug trials as perceived by management and the multidisciplinary team. | Semi-structured Interviews  
Individual Surveys   | CMDHB management; doctors; nurses; pharmacists; dieticians and physiotherapists. |
| Objective 3: To establish the cost and benefit of clinical drug trials as perceived by the larger South Auckland community | Semi-structured Interviews   | South Auckland community including individuals, cultural groups and health related organisations |
| Objective 4: To establish the cost and benefit of clinical drug trials as perceived by government and decision makers. | Individual surveys            | Government politicians and decision makers including central and local government politicians, elected health board members as well as members of the government organisations; Medsafe and PHARMAC |
| Objective 5: To establish the cost and benefit of clinical drug trials as perceived by pharmaceutical companies. | Semi-structured Interviews  
Individual surveys   | The Researched Medicines Industry Association of New Zealand will be asked to supply a purposeful sample to meet this objective. |
| Objective 6: To establish the cost of clinical drug trials to CCRep and CMDHB      | Analysis of accounting data  
Retrospective case-control comparison | Currently reported monthly budget  
Retrospective case-control comparison |
| Objective 7: To bring the above six objectives together by identifying the similarities and differences across these levels of analysis. | Analysis using NVivo 8\(^1\) | All                                                                           |

\(^1\) NVivo 8 software is licensed to QSR International Pty Ltd.
questions, the data collection and the ways in which evidence is interpreted complement one another. In addition, as each method has its own limitations or imperfections these are compensated for by using a mixture of methods (Brewer and Hunter 1989). Objectives 1-5 in the CTCBA use qualitative methods while objective 6 uses quantitative methods and objective 7 uses mixed methods. The qualitative methods include focus groups, interviews and qualitative surveys. The quantitative methods include an analysis of accounting data and a retrospective case-control comparison. Different methods are considered for each participant group to allow for communicative preferences. Hoffman (2009) asserts that communicative preferences explain why research methods that are optimal for some participants, shut down meaningful participation for others and suggests that research methods should be selected according to the communication preference of the participant not the researcher (Hoffman 2009 p 10).

While there are important advantages and disadvantages (for the researcher) associated with the use of different types of research methods within the same study, I will point out that if the object of the game is to stimulate participation in the research; using a variety of methods that corresponds to the communicative preferences of our potential participants, may be a better starting point than our own communicative preferences.

Following consultation at the design stage of the CTCBA some participants indicated a strong preference for one method over another. In particular the pharmaceutical company representatives giving a reason of busy schedules were not keen to participate in focus groups but indicated a willingness to participate in interviews. This was also the case with most politicians. A participant who was involved in conducting clinical trials was happy to complete a survey but again because of time constraints declined to be part of an interview or focus group.

THE RESULTS

Bryman (2007) identifies a range of challenges to the successful integration of mixed methods results, including the tendency for qualitative and quantitative results to be written for different audiences, the frequent availability of quantitative data before qualitative findings (due to the time needed to conduct
qualitative studies), and the limitations imposed by qualitatively or quantitatively focused journals. One solution is to consider and present the results of mixed methods phases separately. This solution can result in missed opportunities to capitalise on the potential that mixing methods can bring (Hall and Howard 2008). Stange, Crabtree, and Miller (2006) suggest that where qualitative and quantitative findings are complex, results should be published in separate qualitative and quantitative forms as well as in a mixed methods form. Hall and Howard (2008) support the presentation of individual and mixed-paradigm results suggesting that there should be no expectation that the two types of results ‘will confirm, support, or cancel out one another (we are not in search of a single truth) but rather that multiple perspectives are provided on one subject’ (p 254). A pragmatic model suggests the results should be presented in a way that best suits the situation and intended audience. We intend therefore to present the qualitative and quantitative results for the CTCBA as standalone manuscripts but will also bring these results together in a combined analysis.

**CONCLUSION**

This paper has illustrated research design choices in a current research project to bring out how they may be made. The practical application was illustrated through an example of mixing methods in a cost benefit analysis. A triangulation mixed methods design is used, a design in which different but complementary data is collected on the same topic. In this study the costs and benefits of clinical drug trials are quantified using data from a retrospective case-control study. Concurrent with this data collection, qualitative focus groups, interviews and semi-structured surveys are used to explore the costs and benefits as perceived by decision makers, pharmaceutical company representatives, staff participants and caregivers. The reason for collecting both quantitative and qualitative data is to bring together the strengths of both forms of research to compare, validate and corroborate results.
REFERENCES


DePoy E & Gitlin L N (1994) *Introduction to research: Multiple strategies for health and human
services. St. Louis, MO: C. V. Mosby.


