

Review paper

## MIXED METHODS RESEARCH IN THE HEALTH SCIENCES: A REVIEW

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**Abstract.** This paper provides health science researchers new to mixed methods research with a review of the purpose of mixed method studies, an overview of the debate surrounding the method's philosophical underpinnings and a discussion of the most popular mixed method design classifications. It is argued that despite its limitations, mixed methods research has contributed to health science research, and allows researchers to profit from the benefits of combining quantitative and qualitative data in the same study while minimising their individual shortcomings. In so doing, researchers are able to answer complex real-world research questions typical of the health sciences. Additionally, it is argued that mixed methods research in the health sciences is best served by the paradigm of pragmatism and that while various mixed method typologies exist, the most popular classifications have common elements.

**Keywords:** mixed methods, research methods, health science, review, typology

### 1 Introduction

The term “mixed methods research” generally refers to studies that integrate both quantitative and qualitative research within a single investigation (Bryman, 2012). This methodological movement has emerged in opposition to the quantitative-qualitative dichotomy (Tashakkori & Newman, 2010) and as a result of the tensions that resulted from the paradigm wars instigated by proponents of these two methods (Cameron, 2009).

Mixed methods research features regularly within health science research (Östlund et al., 2011). As many health science issues are complex, mixed methods research allows researchers the opportunity to gain a greater, more meaningful understanding of such problems and answer questions that may have been less than fully answered

had quantitative or qualitative data alone been used (Halcomb & Hickman, 2015; Ozawa & Pongpirul, 2014). Despite this evident advantage, and the growing popularity of this research method, many researchers still hold back from employing it. O’Cathain, Nicholl and Murphy (2009) reported that a key barrier discouraging health science researchers is a lack of knowledge and training. They cite in particular a lack of education on the various mixed method design typologies and about the methods by which quantitative and qualitative information is integrated.

This article aims to provide individuals new to mixed methods research with an overview of (i) the recent history and purpose of mixed method studies, (ii) debates surrounding their philosophical underpinnings and (iii) a discussion of the most popular mixed method design typologies (classifications). The overall objective of the review is to familiarise the reader with the mixed method approach and facilitate an awareness of the types of complex health science research questions to which mixed methods can make a valuable contribution.

### 2 Methods

Papers were selected for inclusion in this *narrative review* (Grant & Booth, 2009) if they were published in English and dealt with mixed methods research and its application in the health sciences. The authors primarily used peer-reviewed journal papers; however, books, book chapters and documents by experts in the field were also utilised.

A broad search strategy was used to identify potential articles in order to identify as many relevant texts as possible. Several search engines, including PubMed, ScienceDirect, Ovid, Web of Science, PsycINFO, Google Scholar and the University of Malta’s HyDi were used. Google was used to identify books, book chapters and grey literature (other, non-commercial articles and information).

### 3 The Recent History and Purpose of Mixed Methods Research

Formerly known as “mixed research,” mixed method studies were initially carried out within cultural anthropology and fieldwork sociology (Johnson, Onwuegbuzie & Turner, 2007).

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Johnson et al. (2007) noted that Campbell and Friske (1959) formalised the concept of converging more than one research method in order to ensure that the explained variance was the result of the phenomenon being studied. This was later termed *triangulation* by Webb et al. (1966). During the 1970s and 80s, mixed methods continued to develop and challenged quantitative research which had dominated several fields, including health science, for several decades (Mertens et al., 2016). Amongst the important developments during this period, Denzin (1978) noted that triangulation could result in three outcomes: convergence, inconsistency and contradiction. Whichever of these outcomes prevailed, a superior explanation of the studied phenomena was achieved.

The method was further elaborated upon by Morse (1991), who proposed that combining qualitative and quantitative methods could greatly benefit health science research. The author suggested that data could be combined in two ways: data could be collected separately and then combined later during interpretation (simultaneous triangulation), or the results of one method could be used to plan the following method (sequential triangulation).

Mertens et al. (2016) noted that a book by Tashakkori and Teddlie (1998) on the topic of mixed methods research was a milestone in the development of the topic. The book brought together a summary of the early ideas and facilitated the development of the basic terminology of mixed methods research. This led to rapid acceptance and use of this research method.

In recent years, mixed methods research has been given various names and definitions. Following an analysis of 19 definitions of mixed methods research from prominent mixed method researchers, Johnson et al. (2007, p. 123) defined “mixed method research” as:

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

By means of standardising the information that is to be collected, quantitative methodologies are able to assess patterns across a large number of variables and infer causality. However, this standardisation limits the methodology’s ability to generate unexpected information and the reasons underpinning respondents’ answers (Bryman, 2012; Pasick et al., 2009; Scott et al., 2011). For example, armed with questionnaire data, Glover et al. (2005) were able to identify and quantify the causes of musculoskeletal injuries in over 3,000 physiotherapists. However, as is the case in such surveys, no data on related issues (as perceived by physiotherapists) which were not covered by the questionnaire, or knowledge on the nature and degree of influence of factors that informed responses, was available. For example, the survey found that only a negligible amount of injured physiotherapists used electrotherapy in place of manual techniques as a preventive strategy in response to

getting injured. No information on why this strategy was unpopular was reported, however. The opposite holds true for qualitative methodologies where standardisation is limited and information is typically collected from smaller samples. Qualitative research provides insights into participants’ underlying reasons for their answers, is richly nuanced and is open to the identification of unexpected processes (Bryman, 2012; Pasick et al., 2009; Scott et al., 2011). For example, this was highlighted in a study by Happell et al. (2013) whereby six exploratory focus groups allowed for the occupational stressors affecting 36 nurses to be identified. The generalisability of the findings, however, was limited.

By making use of both methodologies, mixed method data collection intentionally utilises the benefits of each methodology while minimising their limitations to best answer research questions (Creswell et al., 2003; 2011). This also allows a mixed method approach to address broad research questions and, by means of integrating findings acquired via contrasting methodologies, provides more robust and rigorous conclusions (Cronholm & Hjalmarsson, 2011). This is particularly relevant within health services research, where research questions can be complex due to the multi-factorial and holistic nature of health and illness and where there exists an established patient-centred multidisciplinary perspective (Glogowska, 2011). Quantitative and qualitative methodologies are thus combined within mixed methods research to achieve an understanding of a phenomenon that is greater than the sum of its parts (Scott et al., 2011).

A number of published texts have made the case for combining quantitative and qualitative research (Johnson et al., 2007). Examples include Sechrest and Sidani (1995), and later Collins, Onwuegbuzie and Sutton (2006). More recently, Tashakkori and Newman (2010) identified seven reasons often given for using mixed methods.

- (1) Complementarity – to integrate two different but connected answers to a research question: one reached via a quantitative approach and the other by means of a qualitative one.
- (2) Completeness – to gain a greater understanding of the phenomenon under investigation by merging qualitative and quantitative findings.
- (3) Development – to use the first phase of a study to obtain research questions, data sources or sampling frameworks for the second phase of a study.
- (4) Expansion – as in “development” but with the aim of elaborating on the information obtained in the first phase of a study.
- (5) Corroboration/confirmation – to determine the integrity of inferences attained from a strand of a study by means of integrated methods.
- (6) Compensation – to compensate for the weaknesses of one method via the strengths of the other.
- (7) Diversity – to compare and contrast divergent representations of the same phenomenon (as discussed later in the Dialectic approach).

While the advantages of utilising mixed methods are persuasive, the methodology has some limitations.

Johnson and Onwuegbuzie (2004) noted that due to a lack of resources, time and understanding, many researchers may find it difficult to undertake both quantitative and qualitative research, particularly if these are to take place concurrently. They are often more expensive to conduct because of the greater resources required to carry out both types of research and generally require more time to undertake (Zou, Sunindijo & Dainty, 2014). Issues also exist with the philosophical underpinnings of this methodology as well as research method typologies that guide it, criticisms that are covered in the following sections.

#### **4 Philosophical Considerations in Mixed Methods Research**

Although mixed methods research appears to offer a solution to the limitations of using quantitative or qualitative research methods in isolation, it has also received considerable criticism (Zou et al., 2014). Bryman (2012) identified two key arguments against the use of mixed methods research.

(i) The belief that research methods are embedded within commitments of what constitutes valid knowledge and how this can be obtained (epistemological commitments). The constructionist worldview, for example, which is generally linked with qualitative research methods, views reality as socially constructed by and between the people who experience it. Thus, while reality is independent of the individual, it is also viewed as subjective and need not be shared by others (Darlaston-Jones, 2007). On the other hand, in positivism, which is generally linked with quantitative research methods, reality is viewed as quantifiable, objective and universal. Reality is therefore considered the same for everybody and by means of the application of science, this shared reality can be identified and described (Darlaston-Jones, 2007).

(ii) The argument that quantitative and qualitative research are separate paradigms. For example, quantitative research emphasises that the researcher takes an impersonal role, tests theories (deductive approach), collects variables in a structured and validated manner, and obtains findings which can be generalised in order to describe numerically, predict and/or achieve causal explanations. Qualitative research, on the other hand, emphasises that the researcher takes a more personal role, generates theory (inductive approach), and collects words and images in an in-depth manner, in order to achieve a subjective description, exploration or an empathic understanding (Antwi & Hamza, 2015).

The criticisms, however, are open to debate as the concept that specific research methods carry fixed epistemological and ontological implications (about what constitutes reality and how individuals understand existence) is rebutted by the potential of each method to be used in a wide variety of research tasks. Morgan (2007) also highlighted how the term “paradigm,” originally coined by Kuhn (1970), is used inconsistently. Morgan (2007) identified at least four different categories of meaning for the term. These included: (i) a world view, (ii) an epistemological stance, (iii) shared beliefs among members of a speciality area, and (iv) model

examples of research. While the third category is closest to Kuhn’s (1970) view of a paradigm, and is the most common form used in scientific research, it has received little attention within discussions of social science methodology which tend to focus on the second category: a paradigm as an epistemological stance (Morgan, 2007). In contrast, Hall (2013) noted that it is the first category of meaning, paradigms as a world view, that was traditionally adopted by authorities on the topic of mixed methods research (e.g. Creswell & Plano Clark, 2007; Teddlie & Tashakkori, 2009), with stances being taken for each of ontology, epistemology, axiology and methodology. It is worth noting, however, that having discussed Morgan’s (2007) findings, Teddlie and Tashakkori (2010, p. 14) described a paradigm as a “shared belief in a research field”, noting that it reflected Morgan’s and Kuhn’s preferred definition. However, whilst Creswell (2011) acknowledged that some scholarly discussion was shifting from identifying one or more paradigms for mixed methods to focusing on paradigm use among members of a research field, he also asserted that the issue of the methodology’s philosophical underpinnings has to be acknowledged and tackled.

Four world views are commonly accepted: postpositivism (and positivism), which is linked to quantitative data collection methods and analysis; constructivism/interpretivism, which is most often aligned with qualitative data collection methods and analysis; the transformative world view; and pragmatism (MacKenzie & Knipe, 2006). In view of the seemingly incompatible paradigms underpinning them, mixed method researchers have struggled to find a common position in determining a rationale for combining quantitative and qualitative data (Hall, 2013). This has resulted in diverse philosophical positions being taken by different mixed method researchers (Creswell et al., 2011) and whilst constructivists are known to have made use of mixed methods (MacKenzie & Knipe, 2006), it is the latter two world views which have received most support.

The transformative paradigm arose to address issues of social inequalities, minority groups and social justice (Mertens, 2012) by means of bringing visibility to those who had been shunned to societal margins and by allowing them to be heard within the world of research (Mertens et al., 2010). The transformative paradigm contends that privilege and power influence all aspects of the research process (Mertens, 2007; Mertens et al., 2016), and that by means of the paradigm, contextual factors such as social justice, power and oppression are addressed in the type of research questions asked, the types of designs used, the manner in which they are used, and the kind of information gathered (Mertens et al., 2010). In view of the paradigm’s purpose, Mertens (2007, p. 219) suggested an “inclination” to use mixed methods as the methodology of choice and to consider the benefits of allowing community members to participate in data collection decisions.

Hall (2013), however, noted that as a paradigm for mixed methods, the narrow focus of the transformative world view limits its application to only certain types of social research. Additionally, Biddle and Schafft (2015) stated that the transformative paradigm is primarily focused on

ethics and values (axiology), with its central tenet being to prioritise the lives and experiences of the discriminated and oppressed in order to improve social justice, but it then provides less emphasis on ontology and is less equipped to provide guidance on methodology. The authors noted that the methodological imperatives of the transformative paradigm remained pragmatic in essence and thus question whether the transformative paradigm represents a different paradigm to pragmatism, or if it complements it by providing pragmatic researchers with axiological direction.

A pragmatic approach has been advocated by a number of researchers (e.g. Cameron, 2009; Cronholm & Hjalmarsson, 2011; Johnson et al., 2007; Morgan, 2007). Pragmatism values both objective and subjective knowledge, in terms of methodologies focusing on what “works” (Johnson & Onwuegbuzie, 2004; Morgan, 2007) and is oriented towards studying real world problems rather than the nature of knowledge (Hall, 2013). Pragmatism challenges claims by methodological purists that qualitative and quantitative methods represent two different worlds that cannot be integrated. Rather, in view of the different methods’ respective strengths and weaknesses, pragmatism views them as complementary (Cronholm & Hjalmarsson, 2011) and interdependent, with the ensuing advantages of mixing methods outweighing potential disadvantages (Scott et al., 2011).

The use of pragmatism within mixed methods research is not, however, without its critics. For example, Greene (2008) noted that work needs to be conducted to understand how the assumptions and stances of this paradigm influence enquiry decisions. Similarly, Hall (2013) cited the difficulty of determining the mixed methods design which “works” prior to using it. It is also worth noting that whilst pragmatism is mixed method researchers’ most popular single paradigm, several versions of it exist (Teddlie & Tashakkori, 2010).

While the discussion has so far dealt with the difficulty of accommodating both quantitative and qualitative research within the same paradigm, other approaches exist. Two alternatives include taking an a-paradigmatic stance or utilising a multiple paradigm approach (Hall, 2013). The first approach refers to overlooking the paradigm issue under the premise that methodology is unrelated to epistemology. Hall (2013), however, asserted that epistemology still contributes during interpretation of the gathered data, thus questioning the validity of this approach. Teddlie and Tashakkori (2010) identified three categories of the latter multiple paradigm option, which were labelled the complementary strength stance, the dialectical stance and the multiple paradigms stance. All three approaches highlight the benefit of utilising multiple paradigms to understand a phenomenon, but vary in their method of doing so.

The *complementary strength stance*, for instance, recommends keeping different methodologies as separate as possible to maintain and draw on the strength of the different paradigms (Morse et al., 2006). For example, Akinlua et al. (2016) conducted a systematic review of health care providers’ and lay individuals’ beliefs about hypertension. The authors identified articles which provided quantitative and qualitative data on the topic, analysed these separately

and only integrated the data within the discussion section of their study. A comparative study by Baldacchino and Bonello (2013a, b) on anxiety and depression among Maltese older adults in residential care homes in Malta and Australia also appears to fall under this category. Quantitative data on anxiety and depression levels were collected first. Subsequent face-to-face interviews then provided qualitative data that identified factors contributing towards residents’ anxiety and depression. The results of the two phases were then compared in the study’s discussion.

The *dialectical stance*, on the other hand, views paradigms as historical and social constructions and thus, while being valuable, they are not unalterable. Those who employ this stance consider opposing philosophical viewpoints and believe that the resulting tension created is beneficial (Greene, 2008). This stance was used, for example, by Nicca et al. (2012) who studied symptom management of individuals living with Human Immunodeficiency Virus (HIV). Qualitative data were initially gathered in order to form hypotheses which were then tested via quantitative data. As the researchers considered the HIV population to be a complex pluralistic society, a dialectic stance was applied, with a synthesis of the results developing from the tension caused by the gathered opposing viewpoints.

Finally, the *multiple paradigm stance* suggests that a researcher should choose the paradigm which is most appropriate given the research design being employed. For example, whilst post-positivism might take the lead in a sequential design which predominantly uses quantitative methods, interpretivism might be more fitting when a sequential design makes greater use of qualitative methods (Creswell et al., 2003).

It is thus evident that a multitude of philosophical positions have been taken by mixed method researchers and while pragmatism appears to be the most frequently cited stance, debate is ongoing. In fact, Bazeley (2004) commented that paradigmatic issues may remain unresolved due to the inability to research or prove paradigms. Mixed method health science research, however, is likely to be best served by a pragmatic world view as it focuses on the value and applicability of research to the real world and adopts the combination of diverse research strategies based on what works in practice (Creswell & Plano Clark, 2011; Lavelle, Vuk, & Barber, 2013).

## 5 Mixed Method Design Typologies

Design typologies feature regularly within the mixed method literature. Teddlie and Tashakkori (2010) provided four reasons for this: (i) they establish a common language within the mixed method field, (ii) they provide interested researchers with blueprints, (iii) by introducing designs that are dissimilar from those in qualitative or quantitative research, they legitimise mixed methods research, and (iv) they are of value for pedagogical reasons. Numerous such typologies exist and their development is ongoing. This section thus does not aim to be definitive and instead, two of the more frequently used typologies will be discussed.

Tashakkori and Newman (2010) suggested that mixed method designs can be divided into four families: parallel, sequential, conversion and fully integrated. The decision of which family to adopt derives from the investigator's answer to two broad questions.

The first question concerns determining the sequence of steps that provides the optimal opportunity to answer the research questions. In *parallel designs*, quantitative and qualitative data are collected and analysed either simultaneously or with a time lag. Findings are then compared, resulting in more complete and meaningful conclusions. As an example, this design was utilised by Beck and Gable (2012) to explore secondary traumatic stress in labour and delivery nurses. Participants were asked to complete a quantitative secondary traumatic stress questionnaire as well as to describe their experiences of being present during a traumatic childbirth by means of an essay. Following analysis of the data, results were mixed during the interpretation, leading to a more robust analysis.

On the other hand, *sequential designs* involve two phases of data collection, with the second phase's research questions, sample, data and its analysis being rooted in the results of the first phase. For example, Cole (2009), who has explored the hand hygiene competence of student nurses, conducted an initial questionnaire study which collected quantitative data, the results of which then informed the design of an interview schedule used in a second qualitative phase, thus allowing the author the opportunity to explore, expand and confirm the findings of the first study. As a further example, Bailey and Hutter (2008), who studied HIV/Acquired Immune Deficiency Syndrome (AIDS) risk behaviour in Goa, India, first conducted interviews and focus groups in order to collect qualitative data. The themes that originated from this first phase were in turn used to design a questionnaire that collected quantitative data from a larger sample. The benefits of this design include the possibility of developing a quantitative tool which is relevant to the target sample, the ability to explore whether qualitative findings can be generalised to the wider study sample, as well as the possibility of drawing more meaningful conclusions by means of comparing quantitative and qualitative findings.

The second question highlighted by Tashakkori and Newman (2010) on which family to adopt entails the possibility of *converting* one type of data to another. This refers to modifying, for example, the qualitative themes identified following a thematic analysis to numerical indicators in order to allow them to be analysed statistically and integrated with one's quantitative findings. Alternatively, quantitative findings may be transformed into qualitative data. This design was used, for example, by Adolfsson et al. (2011) who studied professionals' perceptions and applications of a classification of children's functioning and disability. Here, qualitative statements were gathered, from which themes emerged, and these were in turn classified into groups and analysed statistically. Tashakkori and Newman (2010) suggested that whilst researchers may choose to use one mixed method design family from parallel, sequential, or conversion, they may instead elect to use a combination

of these three families, known as the "*fully integrated mixed method design*".

Another popular typology is that of Creswell and Plano Clark (2011), who also differentiated between four categories of research design. *Convergent designs* (also known as parallel or concurrent) refer to a design where quantitative and qualitative data are collected concurrently. Equal priority is placed on either method and analysis is conducted independently, with results being mixed during overall interpretation. This design was utilised by Beck et al. (2009) in order to analyse the experiences and quality of life of older adult cancer survivors. Quantitative surveys and qualitative interviews were carried out simultaneously but independently and then repeated after two months. Findings from the two methodologies were then compared during the final interpretation stage in order to give a more complete picture.

*Sequential design* refers to a study split into two phases, with the second phase being designed to follow the first. The authors differ between two forms of sequential design, known as explanatory sequential design, where a quantitative study is followed by a qualitative study in order to explore and explain the earlier statistical findings, and exploratory sequential design, where qualitative data collection first takes the lead to explore a phenomenon, the findings of which are then used to design or choose quantitative instruments. In each of these sequential designs, the priority is usually placed on the first study. The explanatory sequential design has been employed, among others, in a study of children with mechanical respiratory support needs by Graham, Pemstein, and Palfrey (2008) which investigated the number of children needing respiratory support and gathered information on the challenges encountered in providing these individuals with multidisciplinary support (e.g. physical, speech and occupational therapy). The authors first acquired relevant quantitative data regarding the provision of services to such individuals from a census, analysed this and then presented their results to focus groups of key informants in order to elicit a discussion which explained and elaborated upon the earlier quantitative findings. Jones and Haynes (2006) also used a similar design to explore sexually transmitted diseases (STDs) in young people. A survey was first sent out to participants to explore the association between their knowledge of such diseases and their behaviour. This was then followed up by a number of focus groups in order to examine the young individuals' understanding of the negative outcomes of STDs in greater depth. On the other hand, a study by Beatty et al. (2004) made use of an exploratory sequential design to explore the use of rehabilitation outcome information in the acute inpatient rehabilitation 'industry'. The authors first conducted a series of telephone interviews with stakeholders and followed these up with a survey. Davila (2006) used an exploratory sequential design to develop, implement and evaluate an in-service programme about intimate partner violence. By means of a series of interviews, the researcher determined public health nurses' learning needs. A learning event was then developed and a quantitative survey of nurses' knowledge on the topic was administered prior to and following the event.

*The embedded design* (also known as nested design) involves collecting quantitative or qualitative data via a traditional design, but with a qualitative strand being added to a quantitative design (or vice versa). This is carried out with the aim of refining thinking or providing new insights. An example of this approach is provided by Victor, Ross, and Axford (2004) who analysed the impact of a care-based health promotion intervention for individuals with knee osteoarthritis. A randomised controlled trial was set up, which included an initial structured interview and a number of quantitative outcome measures for pain, quality of life, mental health, coping with arthritis and osteoarthritis knowledge. A qualitative strand was also incorporated in order to explore participants' experience of living with the disease and individual goals, amongst other factors. This was accomplished by means of a structured baseline interview with open-ended questions, patient diaries kept for the duration of the intervention where participants reviewed their symptoms, detailed medication use and identified their goals, and finally by an analysis of themes that emerged from discussions of patients' experiences during group teaching sessions.

*Multiphase designs* refer to multiple projects with a common purpose that are conducted over time and generally involve sequential and convergent elements. A three-year study of the integration of nurse practitioners into clinical practice in British Columbia (Sangster-Gormley et al., 2015) provides an example of this research design. An initial quantitative survey of patient patterns was followed by qualitative focus groups with relevant stakeholders in the first year of the project. In the second year, four research studies were carried out concurrently: patient surveys and co-worker surveys with both quantitative and qualitative elements, qualitative focus groups and qualitative interviews with nurse practitioners. The findings of these stages led to qualitative case studies and patient interviews in the third year of the study, as well as a quantitative survey of patient patterns. The sequential nature of this project, where the design of most of the qualitative elements emerged from the preceding stages, ensured that information collected was relevant and at the same time allowed researchers to explore data from the earlier stage in further detail.

While both typologies include many similar components, it is worth noting that each has developed considerably over the years and this, coupled with the number of other typologies, has led some authors to express discomfort at the lack of consensus and the models' over-refinement (Bryman, 2006). In fact, Bazeley (2009) suggested that in order for mixed methods research to mature, it should focus less on design typologies and more on analytic techniques that support integration. Additionally, Bryman (2006) noted that early commitment to a particular research design is not always possible or good practice as research outcomes in mixed methods are not always predictable. Referring to the proliferation of designs, Teddlie and Tashakkori (2010) suggested that it indicated healthy development within the mixed methods community and expressed confidence that common components of different typologies would be identified and reconciled in the future.

In their analysis of 168 mixed method studies in healthcare research, Östlund et al. (2011) reported that the parallel data analysis approach was most widely used (58%), followed by sequential data analysis (27%) where qualitative studies generally informed the design of clinical tools and research measures for the second phase of the study, or followed quantitative studies to explore their findings in greater depth. In both parallel and sequential data analysis studies, authors rarely addressed the weighting and priority given to each method and thus the impact of the different methods on the studies' findings could rarely be gauged. Östlund et al. (2011) also noted that results of such studies could be classified as *convergent*, where qualitative and quantitative findings lead to the same conclusion, *complementary*, where the two sets of results would supplement each other, or *divergent*, where quantitative and qualitative results provided different, possibly contradictory, results.

## 6 Conclusion

Despite its limitations, mixed methods research is widely regarded as contributing significantly to health science research (Östlund et al., 2011). By combining quantitative and qualitative data in the same study, researchers are able to benefit from the strengths of each approach while minimising their shortcomings. In practice, this endeavour facilitates health science researchers' investigations into the complex and multifactorial nature of human health and illness.

Researchers who employ a mixed method approach for the first time can easily feel overwhelmed by uncertainty regarding the method's philosophical underpinnings as well as the plethora of mixed methods research typologies. While further research and debate is warranted, health science researchers seeking solutions for real-world problems are increasingly accepting pragmatism as the paradigm of choice.

While a common typology that has the potential to introduce a universal language to mixed methods research remains elusive, the most popular classifications do have common elements. The favoured typology will depend on the research questions, but in most cases researchers choose between either collecting quantitative and qualitative data simultaneously, often termed a parallel design, or collecting data in phases - a sequential design. Whilst the results of parallel designs are pooled at the end of data collection, providing a final rich dataset, the sequential design allows the results of the early phases to guide the development of procedures and instruments for later phases. When, for example, phase one involves qualitative data, phase two generally involves the development of a research tool to identify if qualitative findings can be generalised to the wider study population. Alternatively, when phase one involves quantitative data, the second phase often revolves around explaining initial findings. Whichever method is chosen, mixed methods provide researchers with the opportunity to develop richer and more meaningful data through their integration of qualitative and quantitative findings.

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## 8 Conflicts of interest

The authors report no conflicts of interest.

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