Chapter 7
Importance of Mixed Methods Research in Pharmacy Practice

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Abstract Irrespective of the field of research, the underpinning methodologies used are critical in generating high-quality data and evidence. Most importantly, the method selected should answer the research question that has been posed. It is important to accept that no single method will answer all research questions, and in the field of health services and pharmacy practice research, there may be a number of questions that will form part of an overarching programme or project. In such circumstances, more than one method will be required to answer all the research questions within a single programme or project, an approach known as mixed methods.

This chapter provides an overview of the current definition of mixed methods research and the advantages and limitations of this approach. The importance of mixed methods research in pharmacy practice and the considerations required when designing and analysing a mixed methods research study or programme are outlined. The various typologies of mixed methods research are described using illustrative examples from the pharmacy practice research literature, and guidance is provided on choosing the most applicable type/typology for a given research question. Key considerations in appraising and reporting mixed methods research are also outlined.

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7.1 Introduction

Irrespective of the field of research, the underpinning methodologies used are critical in generating high-quality data and evidence. Most importantly, the method selected should answer the research question posed (Sackett 1997). Traditionally, research studies have been designed using single method research designs. However, single method research studies often report various limitations and weaknesses in their study design; for example, single study designs do not consider multiple viewpoints and perspectives (Johnson et al. 2007; Driscoll et al. 2007).

Consequently, the practice of using more than one research method, or a mixed methods approach as it is more commonly termed, to answer the research question posed has become increasingly popular. This enables expansion of the scope or breadth of research to offset the weaknesses of using any approach alone (Driscoll et al. 2007). Mixed methods research is now a recognised research paradigm in the health services and pharmacy practice research fields. This is evidenced by the publication of a dedicated journal of mixed methods research, the *Journal of Mixed Methods Research*. This journal aims to act as an impetus for creating bridges between mixed methods researchers and to provide a platform for the discussion of mixed methods research issues and the sharing of ideas across academic disciplines (Tashakkori and Creswell 2007).

Despite the relative novelty of this approach in the health services research arena, the process of using more than one research method within a single study or a research programme has been conducted for decades in other research fields. As noted above, mixed methods research adds further insights to research questions which would otherwise not be answered if a single research approach was used. Whilst this chapter focuses on mixed methods research in pharmacy practice, a mixed methods approach may not always be appropriate. It is important to refer back to the research question posed and to let the research question guide the study design. The selection of study design should be considered in tandem with the way in which the research question is asked, and in some instances, single study designs may be preferable. Sackett emphasises the importance of letting the research question guide the study design, stating that 'the question being asked determines the appropriate research architecture, strategy, and tactics to be used- not tradition, authority, experts, paradigms or schools of thought' (Sackett 1997).

A variety of terms have been used to describe the mixed methods research approach including 'integrated', 'hybrid', 'combined', 'mixed research', 'mixed methodology', 'multi-methods', 'multi-strategy' and 'mixed methodology' (Bryman 2006; Johnson et al. 2007; Driscoll et al. 2007). Throughout this chapter, we will use the term 'mixed methods' to describe research approaches which use more than one research method to answer the research question posed.

This chapter provides an overview of the current definition of mixed methods research and the advantages and limitations of this research approach. The importance of mixed methods research in pharmacy practice and the required considerations when designing and analysing a mixed methods research study or programme will be outlined. We also describe the various typologies of mixed methods research using illustrative examples from the pharmacy practice research literature and

provide guidance on how to choose the most applicable typology for a given research question. Key considerations in appraising and reporting mixed methods research are also outlined.

To inform this chapter, we conducted a literature search using the following electronic databases: International Pharmaceutical Abstracts, MEDLINE and Web of Science, and using the following search terms: 'mixed-methods', 'pharmacy, 'triangulation', 'parallel design', 'embedded design' and 'sequential design'. Searches were restricted to include only full-text papers published in the English language within the last 15 years (2004–2019).

7.2 Current Definition of Mixed Methods Research

Mixed methods research can be viewed as a distinct category of multiple methods research. Multiple methods research (also referred to as multi-methods research) is an overarching term that refers to all of the various combinations of research methods involving more than one data collection procedure (Fetters and Molina-Azorin 2017). This can include combinations of exclusively qualitative and/or quantitative approaches. As the field of mixed methods research is still evolving, several researchers believe that the definition of mixed methods research should remain open to allow for its development and refinement, as the practice of mixed methods research grows across academic disciplines (Johnson et al. 2007). However, there is a general consensus that mixed methods research typically involves both a qualitative and a quantitative component embedded within a single study or research programme (Tashakkori and Creswell 2007; Creswell et al. 2004; Fetters and Molina-Azorin 2017).

Johnson et al. (2007) approached 19 experts in the field and invited them to propose a definition of mixed methods research to ensure a common and uniform understanding of the term. They subsequently summarised their findings and proposed the following definition:

> Mixed methods research is 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 purpose of breadth and depth of understanding and corroboration. (Johnson et al. 2007)

In addition, they also specified that mixed methods research is a specific programme of research: 'A mixed methods study would involve mixing within a single study; a mixed method program would involve mixing within a program of research and the mixing might occur across a closely related set of studies' (Johnson et al. 2007).

Mixed methods research is therefore a synthesis that can include findings from both qualitative and quantitative research and, importantly, the integration of the findings from each research strand. Integration refers to the interaction between the different research strands (O'Cathain et al. 2010). We outline an approach to integrating findings from different strands of research at the end of this chapter.

7.2.1 Advantages of Mixed Methods Research

The use of a mixed methods approach to research is especially useful in understanding contradictions between quantitative results and qualitative findings. For example, within a large research programme on prescribing errors, junior doctors rated their level of confidence in a variety of prescribing-related tasks, e.g. selecting the most appropriate dose, as very high, overall, in a questionnaire study (Ryan et al. 2013), despite prior indication that they were responsible for a large proportion of prescribing errors identified in a related prevalence study (Ryan et al. 2014). To explore this contradiction and to examine the disparity between doctors' perceived level of confidence and the fact that prescribing errors were often made during the study period, analysis of the qualitative work revealed that doctors were not always made aware of their errors. Additionally, prescribing charts were often amended by other prescribers, without providing feedback to the original prescriber (Ross et al. 2013).

Mixed methods approaches allow participants' point of view to be reflected, provide methodological flexibility and encourage multi-disciplinary teamworking. For example, a research study conducted to evaluate the extension of prescribing rights to pharmacists consisted of a number of linked phases, which were qualitative and quantitative in nature (McCann et al. 2011, 2012, 2015). The research team consisted of pharmacists, a general practitioner (GP) and an economist. This mix of disciplines contributed to a more holistic overview of the research topic and ensured that the research objectives would be met. The study phases consisted of a cross-sectional questionnaire which was completed by qualified prescribing pharmacists (McCann et al. 2011). The questionnaire provided the quantitative baseline and background data that were explored in subsequent qualitative phases (McCann et al. 2012, 2015). Pharmacists, physicians and other healthcare professionals with a vested interest in prescribing participated in interviews which revealed the advantages and disadvantages of prescribing in greater depth than would have been gleaned from a quantitative questionnaire alone (McCann et al. 2012). However, further qualitative work with patients, who had experienced prescribing by a pharmacist, via focus groups, was even more revealing (McCann et al. 2015). Patients recognised the importance of pharmacist input, but they also cited limitations to this new model of care, particularly pharmacists' focus on one medical condition at a time. This issue had been highlighted in much of the pharmacist prescribing literature before, but never from the perspective of patients. Using these various methodologies within the one study enabled a more comprehensive and deeper understanding of how pharmacist prescribing had evolved and provided evidence for policy makers as to how this model of care could be enhanced and extended into more mainstream practice.

7.2.2 Limitations of Mixed Methods Research

Mixed methods approaches to research are labour-intensive and require a broader range of research expertise across a multidisciplinary team than those needed to conduct a single method study. Mixed methods studies are complex to plan and

undertake and can pose challenges in ensuring methodological rigour of individual study components. Furthermore, the integration of data from a number of different sources can be challenging and complex as detailed below.

7.3 Mixed Methods Research in Pharmacy Practice

The use of mixed methods research in pharmacy practice research has been fuelled by a transition in the focus of health services research from a practitioner-centred approach to more of a patient-centred approach. For example, this has been highlighted by research into the development of community pharmacy-based interventions targeting alcohol use. Early work did not report any patient involvement during intervention development (Fitzgerald et al. 2008). However, a study by Krska and Mackridge (2014) describes the use of a mixed methods approach using telephone interviews with key stakeholders and survey data with patients/public to develop their intervention. Additionally, in intervention and implementation research, there is an increasing drive for theoretically derived evidence to inform the development of interventions with a growing emphasis on the science underpinning intervention development. This is illustrated by the United Kingdom's (UK) Medical Research Council's (MRC) influential guidance on the development of complex interventions (Medical Research Council 2008) which is increasingly being used in the design of pharmacy practice interventions (Hughes et al. 2016) (Fig. 7.1).

This has been adopted by pharmacy practice researchers as healthcare interventions are, in general, complex (utilising several components, rather than a single active 'ingredient') and involve a variety of healthcare professionals. Furthermore, as pharmacy practice interventions are often targeted at individual patients, effective interventions need to be tailored to these individuals accordingly.

Each phase of the MRC framework requires the application of different research methods. For example, in order to develop an intervention to improve medication adherence, researchers should firstly identify the extent of the problem of non-adherence (e.g. by quantifying the level of non-adherence) in the development

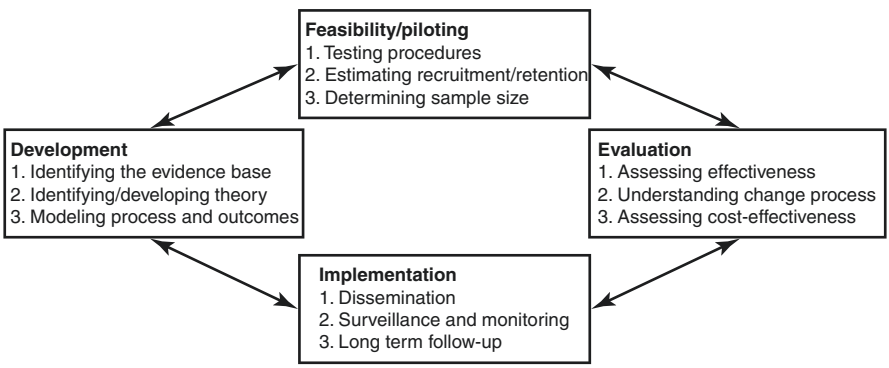

Fig. 7.1 MRC framework for the development of a complex intervention

component and then identify an appropriate theoretical basis to underpin the development of the intervention. In the feasibility/piloting component, the MRC recommends that retention, recruitment and sample size should be estimated (quantitative methods), and intervention procedures should be tested (quantitative and/or qualitative methods). This highlights the important role of mixed methods research in pharmacy practice intervention design as the research question could not be addressed using one method alone.

In order to assess the effectiveness of an intervention, specific outcome measures need to be compared before and after the intervention, e.g. the level of adherence (quantitative), as part of the evaluation component. For the change processes to be identified and understood, i.e. those mechanisms which led to changes in adherence, qualitative methods should primarily be employed to seek participants' views and experiences of the intervention. Finally, an assessment of cost-effectiveness would be quantitative in nature.

In the final component of the framework (implementation) which comprises monitoring, surveillance and long-term follow-up of the intervention, both qualitative and quantitative methods can be used either alone or in combination, but the chosen methods are largely dependent on the intervention being tested and the outcomes of interest. For example, McLeod et al. (2019) used a mixed methods study design involving both quantitative data (direct observations) and qualitative data (semi-structured interviews) to examine the implementation and impact of a hospital-based electronic prescribing and administration system. The direct observations of ward pharmacists' working practices (i.e. quantitative data) before and after implementation of the system provided data on the amount of time the pharmacists spent on different tasks, as well as information on the individuals they engaged with and where the tasks were conducted within the hospital. The interviews with the pharmacists (i.e. qualitative data) explored their perceptions of the impact of the system on ward activities and interactions with patients and other health professionals. Triangulation of the quantitative and qualitative data enabled the researchers to gain a more in-depth understanding of factors that contributed to the observed post-implementation effects of the new system such as changes in the duration of routine tasks.

As conveyed by Fig. 7.1, the various phases of the MRC framework are not necessarily constrained by a rigid sequence, but can be iterative in nature. This type of framework is ideal for the application of mixed methods.

7.4 Typologies of Mixed Methods Research

As stated previously, the choice of research methodology to adopt for a given study depends entirely on the research question. Within mixed methods research, there are a variety of categories, otherwise known as typologies, which help to formalise the

approach taken and which add rigour to research projects (Bryman 2006). There are a number of classification matrices by which mixed methods research designs are described, with no one method having superiority over the other (Driscoll et al. 2007). However, each classification suggests that the factors below should be considered when deciding on the typology to use (Bryman 2006; Driscoll et al. 2007; O'Cathain et al. 2010; Hadi et al. 2013):

- Order of data collection: Are the qualitative and quantitative data collected independently or sequentially?
- Priority: Which type of data has priority, i.e. quantitative or qualitative data?
- Integration: What is the purpose of integration, e.g. triangulation?
- Number of data strands: How many constituent research components are involved?

The following section will describe four of the most common mixed methods typologies used in pharmacy practice research (*concurrent design*, *explanatory sequential design*, *exploratory sequential design and embedded design*), with examples of studies that have used these approaches. Advantages and disadvantages of each approach will also be noted.

7.4.1 Concurrent Design

The concurrent mixed methods design describes an approach whereby both qualitative and quantitative data are collected concurrently, in separate but related studies. This typology is also referred to as the 'convergent parallel design', 'current triangulation', 'simultaneous triangulation' and 'parallel study' (Hadi et al. 2013). Each study is given equal priority and findings are integrated only at the interpretation stage, i.e. studies are seen as separate entities during both data collection and analysis. This approach is useful for validating qualitative data with quantitative data and vice versa. This design facilitates the development of an overall understanding of the research question. For example, Ryan and colleagues used this study design type in the research programme on prescribing errors previously referred to. Whilst there were several components to this research programme, an observational prevalence study (Ryan et al. 2014) and a semi-structured interview study with junior doctors (Ross et al. 2013) were conducted concurrently. Each study was analysed separately, but data were interpreted together. The interview study offered some explanations as to why various types of errors identified in the prevalence study occurred. For example, the prevalence study revealed that errors of omission (i.e. drugs not being prescribed) at admission to hospital were one of the commonest types of errors encountered (Ryan et al. 2014). Findings from the semi-structured interviews somewhat explained these errors, in that interviewees noted difficulties in accessing prescribing information from primary care at the point of patient admission.

7.4.2 Sequential Design

Sequential design studies involve the collection of data on an iterative basis, i.e. data collected in one phase contributes to the data collection in the next phase (Driscoll et al. 2007). Subsequent phases provide more detailed data on findings from earlier phases and can help to generalise findings by verifying and augmenting study results. Sequential design studies can be either **explanatory** or **exploratory** (Hadi et al. 2013). In **explanatory** sequential design studies, the first phase consists of quantitative data collection, and this is followed by a qualitative study, the aim of which is to explain the findings from the quantitative study. The collection of quantitative data first allows application of statistical methods to determine which findings to augment in the next phase (Driscoll et al. 2007). For example, in the first phase of a study investigating prescribing errors in Scottish hospitals, the researchers defined the prevalence of prescribing errors, and in the second phase, the researchers conducted semi-structured interviews with prescribers to determine the causes and under what circumstances the prescribing errors identified in phase one occurred (Ryan et al. 2014). At study completion, i.e. at the end of the qualitative study, data were triangulated to provide a wider understanding of the occurrence of prescribing errors.

Ramsay et al. (2014) used a mixed methods approach to evaluate the effects of a ward-level medication safety scorecard to influence medication safety and the factors that influenced the use of the scorecard. A mixed methods approach was used to gain an understanding of how and why the intervention influenced staff behaviour and whether there were any unintended consequences and which factors were influential (Ramsay et al. 2014). The quantitative component (a controlled before and after study) assessed the performance of this safety scorecard, whilst the subsequent qualitative component involved interviews with hospital staff exploring governance of medication safety, experiences of scorecard feedback and implementation issues. Each component, i.e. the qualitative and quantitative aspects, was analysed separately in the first instance, and the findings were then triangulated. Using this methodological approach allowed for the evaluation of the efficacy of the scorecard, as well as considerations of contextual factors that might influence the implementation of this patient safety initiative (Ramsay et al. 2014).

Similarly, **exploratory** sequential design studies also consist of two distinct phases. The first phase consists of a qualitative study, to explore the research question in depth. Based on analysis of the qualitative data, a quantitative study is then developed to test the findings. For example, Millar et al. (2015) used semi-structured interviews to explore the views and attitudes of healthcare professionals and patients towards medicines management in intermediate care facilities. A questionnaire was subsequently developed which sought to further explore and quantify community pharmacists' views on the issues that were identified through the previous qualitative study (Millar et al. 2016). The questionnaire findings highlighted a lack of awareness and involvement amongst community pharmacists relating to intermediate care. However, community pharmacists also demonstrated willingness to being involved in intermediate care. This stepwise approach involving sequential use of

qualitative and quantitative methods facilitated a logical elucidation of the main issues and challenges faced by those who work in these types of facilities. An interpretation of quantitative findings without an understanding of the contextual factors may have led to invalid or biased conclusions.

Adopting a sequential design approach allows researchers to investigate emergent and unexpected themes in more detail. However, this approach can be time-consuming.

7.4.3 The Embedded Design

The embedded design consists of both a qualitative and a quantitative phase. However, in contrast to the previously mentioned typologies, in the embedded design, one research method is designated as the key method, and the other component of the research adopts a supportive role. In essence, whilst the qualitative and quantitative components of the research study are based on the same broad topic, each research component in the embedded design answers a different research question. This design is often used in randomised controlled trials, where the quantitative component of the research study is the main focus in terms of intervention outcomes. However, the qualitative components can provide important process evaluation information in terms of issues such as implementation. The qualitative component of the research project can be incorporated into the study at any time point, e.g. at the beginning to help in the design of the intervention, during the intervention to explore participants' experiences or after the intervention to help to explain results. This is illustrated by a study which evaluated the impact of a pharmaceutical care model regarding the prescribing of psychoactive medications in older nursing home residents (Patterson et al. 2010). The original model of care (described as the Fleetwood model) had been developed in the United States (USA) by the American Society of Consultant Pharmacists for application by pharmacists in the US nursing home context (Cameron et al. 2002). However, as the model of care in US nursing homes is very different to the rest of the world, this care model required adaptation before it could be used in non-US nursing homes. Thus, a qualitative study was undertaken in Northern Ireland to allow this adaptation to take place (Patterson et al. 2007). Semi-structured interviews or focus groups were held with GPs, nursing home managers, pharmacists and advocates of older people. The American Fleetwood model was explained to all participants who were then asked for their views and opinions on how such a model could be adapted for use in the UK setting. Participants recognised that for such a model of care to work outside of the USA, consideration would need to be given as to how pharmacists would access medical records, prescribers and nursing home residents in order to implement this care model to its full potential. The resultant changes to the model enabled it to be successfully employed in 22 nursing homes as part of a randomised trial. Indeed, the adapted model of care proved to be effective and cost-effective (Patterson et al. 2010, 2011) and has since been rolled out in nursing homes across Northern Ireland.

7.5 Integrating Findings in Mixed Methods Research

As outlined in the definition given at the start of this chapter, mixed methods research does not simply involve the collection of qualitative and quantitative data; integration of findings is a central part of mixed methods research. As previously noted, integration refers to the interaction between the different research strands, and this can be achieved through the triangulation of data (O'Cathain et al. 2010).

Triangulation was initially conceptualised as a means of validating findings, but the focus has since changed and triangulation is increasingly seen as a means of enriching and completing knowledge (Flick 2009). Triangulation has been described as a process of using different methods to study a problem in order to gain a more complete picture (O'Cathain et al. 2010). This can involve the combination of multiple qualitative methods or the combination of qualitative and quantitative methods (Flick et al. 2012). Through the use of different research methods, triangulation seeks to exploit the strengths and neutralise the limitations that are inherent to each method (Jick 1979). In mixed methods research, integration can occur at different levels of the research process, e.g. study design, methods, interpretation and reporting (Fetters et al. 2013). In this chapter we focus on the integration of findings at the level of interpretation using a triangulation-based approach, once each dataset has been analysed separately, as is common practice in mixed methods healthcare studies (Östlund et al. 2011).

Triangulation looks to explore convergence, complementarity and dissonance between the findings of each method (Farmer et al. 2006). Convergence and dissonance refer to the extent to which findings from each method agree or disagree, respectively. Complementarity occurs where findings from different methods provide complementary information on the same issue. The triangulation of data from different methods offers important advantages in that it can generate richer data, uncover unexpected findings that can provide opportunity for enriching explanations and ultimately increase confidence in research findings (Jick 1979).

Triangulation has been classified into four different types (Denzin 1989): methodological triangulation (use of different research methods or data collection techniques), theory triangulation (use of different theoretical perspectives), data triangulation (use of multiple data sources or groups of research participants) and investigator triangulation (use of multiple researchers in data analysis). However, various authors have noted that little guidance has been provided to date on performing triangulation (Jick 1979; Morgan 1998; Östlund et al. 2011). Given the range of typologies in mixed methods research, as detailed earlier in this chapter, there is no single approach to triangulation that can be applied to all mixed methods research. However, as outlined in Farmer's triangulation protocol, there are a number of basic steps (i.e. sorting, convergence coding, convergence assessment, completeness assessment, researcher comparison and feedback) that can be followed in order to provide methodological transparency where triangulation is used in any given research context (Farmer et al. 2006). This triangulation protocol is considered to provide the most detailed account of how to triangulate data and is applicable to mixed methods in health research (O'Cathain et al. 2010).

The triangulation of data within mixed methods research requires decisions about the weighting given to each dataset. As noted by Jick (1979), in the absence of guidelines for systematically ordering data decisions regarding the weighting of different study components, decisions are likely to be subjective. Farmer et al. (2006) propose that decisions about weighting should be based on the contribution of the different components to the research question.

The use of a triangulation protocol can help to improve the quality and reporting of mixed methods research and to address deficiencies that have been identified in the existing mixed methods literature relating to pharmacy practice (Hadi et al. 2014), as well as the wider healthcare literature (Östlund et al. 2011). The application of Farmer's triangulation protocol is exemplified below by reference to a research project undertaken by the authors to develop an intervention to improve appropriate polypharmacy in older patients in primary care (Cadogan et al. 2015, 2016).

7.5.1 Case Study: Application of a Triangulation Protocol in a Mixed Methods Project with a Sequential Design

The triangulation protocol outlined below was adapted from the work of Farmer et al. (2006) and developed as part of an ongoing mixed methods research project seeking to develop an intervention to improve appropriate polypharmacy in older patients in primary care. The project comprised several phases, including an update of a Cochrane systematic review (Patterson et al. 2014), semi-structured interviews involving two groups of healthcare professionals (general practitioners, community pharmacists) and a feasibility study of the intervention that was subsequently developed (Cadogan et al. 2015, 2016, 2017). Triangulation was based on the completed analysis of interview data. The topic guide for the qualitative components of the project was based primarily on the Theoretical Domains Framework, an established framework which consists of 12 theoretical domains relevant to changing healthcare professionals' behaviour (Michie et al. 2005). The findings of the Cochrane review were also used to inform part of the topic guides. The main aim of the analysis was to identify the principal barriers and facilitators to changing target behaviours in healthcare professionals, namely, prescribing and dispensing, in order to achieve the desired outcome (i.e. appropriate polypharmacy) through integration of the findings from each dataset. This allowed for different perspectives on the same research question. An established taxonomy of behaviour change techniques (Michie et al. 2013) was then used to target these domains and elicit desired changes in target behaviours. Intervention delivery and related outcome assessments were informed by the findings of the updated Cochrane review.

Prior to triangulation, each qualitative dataset was independently analysed by two researchers using the framework method (Ritchie and Spencer 1994). Qualitative analysis of each dataset followed a deductive approach, and the theoretical framework (Michie et al. 2005) used to develop the topic guides served as the coding framework. The subsequent paragraphs relate to the triangulation of the findings from each dataset.

Triangulation involved multiple investigator triangulation and data source triangulation. As a single theoretical framework was used to analyse the individual datasets, theoretical triangulation was not conducted. Similarly, as a single research method was used to gather the data (i.e. semi-structured interviews), methodological triangulation was not required. Integration of the datasets focussed on the prominence of the framework domains (themes) across the datasets. Although the intervention sought to target healthcare professionals, it was also imperative that it would be beneficial to older patients who were receiving polypharmacy in primary care. Thus, the findings from each dataset (general practitioners, community pharmacists) were weighted equally as both groups of participants interacted with this patient cohort.

1. **Sorting**: Findings from each dataset were reviewed in order to identify key domains within the Theoretical Domains Framework that would need to be targeted as part of the intervention.
2. **Convergence coding**: A convergence coding matrix was developed and applied to compare the presence, frequency and examples of domains across the datasets. This allowed differences and similarities between datasets to be summarised. Convergence focussed on the prominence of domains across the datasets and the convergence of coverage (i.e. level of agreement/disagreement across the datasets).
3. **Convergence assessment**: All comparisons across the datasets were reviewed to provide a comprehensive assessment of the level of convergence. Any cases where researchers' views on convergence or dissonance differed were documented.
4. **Completeness assessment**: Findings from the datasets were compared to create an overarching summary of the findings, highlighting both unique and similar contributions to the research question. For example, both groups of healthcare professionals were aware of the potential for adverse outcomes (e.g. drug interactions, non-adherence), if actions were not taken to improve appropriate polypharmacy in older patients ('beliefs about consequences') (Cadogan et al. 2015). Despite identification of similar challenges within a number of domains that formed part of the coding framework (e.g. limited available time and work environment pressures under the 'environmental context and resource' domain), differences were identified in the groups' perceptions of other domains as barriers or facilitators to prescribing/dispensing of appropriate polypharmacy. For example, under the 'social/professional role and identity' domain, pharmacists were conscious of professional boundaries with GPs in recommending changes to older patients' existing prescriptions, whereas GPs viewed teamwork with pharmacists favourably.
5. **Researcher comparison**: Formal assessments can be used to compare the level of agreement between the researchers in terms of the degree of convergence across the datasets. For example, Farmer et al. (2006) reported that agreement between two researchers that meets or exceeds 70% can provide acceptable confidence in

the coding process. In the context of the polypharmacy research project, it was intended that any disagreements would be resolved by consensus through discussion with another researcher. However, this was not necessary as there were no disagreements.

6. **Feedback**: Triangulated results were presented to the other members of the research team for discussion. A consensus-based approach was used by the team to agree on the specific domains of the theoretical framework that should be targeted as part of the intervention. Interestingly, based on the research team's review of the summary findings from each dataset, all but one of the domains from the coding framework were considered to be relevant to both the prescribing and dispensing of appropriate polypharmacy to older patients. The importance of the same key domains for both groups highlighted commonalities in the perceived barriers to, and facilitators of, behaviour change within each group. The selected key domains were then mapped to behaviour change techniques from an established taxonomy (Michie et al. 2013) that formed the components of the final intervention.

This thorough and painstaking process yielded rich and informative results which highlighted multiple perspectives on an important issue within primary care, i.e. polypharmacy. A GP-targeted intervention has been developed and undergone feasibility testing (Cadogan et al. 2017). A single focus on a single constituency, e.g. GPs, would have provided a narrow and limited view. Any subsequent intervention development would have considered only this single view, and the resultant intervention may not have identified relevant barriers and facilitators to the prescribing of appropriate polypharmacy for older people in primary care. Researchers should be aware that adopting this kind of triangulation protocol will be time-consuming, but the findings in subsequent types of phases of research should be much more meaningful.

7.6 Enhancing Rigour and Reporting in Mixed Methods Research

Ensuring methodological rigour in mixed methods research is critical in order to maximise its potential to advance the evidence base relating to pharmacy practice and inform relevant policy/practice. Previous reviews have identified deficiencies with the conduct and reporting of mixed methods research (Brown et al. 2015; Wisdom et al. 2012; O'Cathain et al. 2008; Fàbregues and Molina-Azorín 2017; Kaur et al. 2019). For example, a systematic review of health services research involving mixed methods designs identified issues with the rigour of the included studies in terms of a lack of adequate description of study design and justification for a mixed methods approach, as well as a lack of information regarding integration of data from different study components (O'Cathain et al. 2008).

In addition to adhering to existing standards for each of the component methods, researchers must also consider how they will integrate the two components and ensure that they describe this adequately in their final published report (Hadi and Closs 2016).

Work has been undertaken to develop tools and criteria for appraising the methodological rigour of mixed methods research (Sale and Brazil 2004; Heyvaert et al. 2013; Hong et al. 2018). For example, the Mixed Methods Appraisal Tool (MMAT) has been developed to appraise the methodological quality of empirical studies as part of mixed methods systematic reviews (Hong et al. 2018). The MMAT comprises study-specific questions for appraising five different categories of study designs: quantitative randomised controlled trials, quantitative non-randomised studies, quantitative descriptive studies, qualitative studies and mixed methods studies. Responses to each question can be documented as 'yes', 'no' or 'unclear'. In applying this tool to appraise study quality, it is intended that a combination of question categories should be applied relating to each study component (i.e. qualitative and quantitative), as well as the overall mixed methods design. Assessment questions specific to appraising the quality of mixed methods study designs are listed in Table 7.1.

In order for tools such as the MMAT to be applied, studies must be adequately reported. In contrast to other research designs for which established reporting guidelines exist (e.g. 'Consolidated Standards of Reporting Trials' (Schulz et al. 2010) for randomised controlled trials), there are no universally accepted reporting guidelines for mixed methods research. In seeking to address this, the 'Good Reporting of A Mixed Methods Study' (GRAMMS) recommendations have been proposed (O'Cathain et al. 2008). These recommendations cover key considerations when designing a mixed methods study, including the integration of data sources. The GRAMMS recommendations are intended for guidance purposes as opposed to being used as a formal reporting checklist. The recommendations have been adapted for pharmacy practice research (Table 7.2) (Hadi et al. 2014).

As mixed methods research continues to evolve and grow as a paradigm in pharmacy practice research, it is important that researchers make use of available quality appraisal and reporting tools. This will ultimately help to enhance rigour and reporting in mixed methods pharmacy practice research.

Table 7.1 Sample questions from Mixed Methods Appraisal Tool (Hong et al. 2018)

Methodological quality criteria for mixed methods study designs
1. Is there an adequate rationale for using a mixed methods design to address the research question?
2. Are the different components of the study effectively integrated to answer the research question?
3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?
4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?
5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Table 7.2 Recommendations to improve mixed methods reporting in pharmacy practice research

1. Research objectives should be described in a way that clarifies the need for using a mixed methods approach
2. Rationale and justification should be provided for the choice of mixed methods approach in relation to the research question
3. Key elements of the research design (i.e. purpose, priority and timing) should be described using common mixed methods terminology
4. Research methods for each of the component qualitative and quantitative approaches should be described in sufficient detail to enable reproducibility
5. Information should be provided on how and where integration has occurred
6. Any relevant limitations for each of the component qualitative and quantitative methods should be outlined
7. An explanation should be provided of the benefits of using a mixed methods approach to answer the research question
8. An explanation should be provided of the potential implications of the research findings on pharmacy policy, practice and/or education

Adapted from Hadi et al. (2014)

7.7 Conclusion

Using a variety of methods to answer a research question can add further context and explanations to findings and interpretations. We have outlined a variety of mixed methods typologies that are used in pharmacy practice research. It is important to note there is no preferred typology that pharmacy practice researchers should adopt. Instead, researchers should ensure that the methodological approach chosen in a study is suitable for the research question posed. The growing recognition of the contribution of mixed methods to pharmacy practice research should ensure that studies are addressing key research questions in a comprehensive and meaningful way.

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