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From screening to synthesis: using NVivo to enhance transparency in Qualitative Evidence Synthesis

Short Title: NVivo and Qualitative Synthesis

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ABSTRACT

Aims and objectives: The aim of this qualitative evidence synthesis was to explore the experiences and perceptions of health care staff caring for people with dementia in the acute setting. This paper focuses on the methodological process of conducting framework synthesis using NVivo for each stage of the review: screening, data extraction, synthesis and critical appraisal.

Background: Qualitative evidence synthesis brings together many research findings in a meaningful way that can be used to guide practice and policy development. For this purpose, synthesis must be conducted in a comprehensive and rigorous way. There has been previous discussion on how using NVivo can assist in enhancing and illustrate the rigorous processes involved.

Design: Qualitative Framework Synthesis

Methods: Twelve documents, or research reports, based on nine studies, were included for synthesis.

Conclusion: The benefits of using NVivo are outlined in terms of facilitating teams of researchers to systematically and rigorously synthesise findings. NVivo functions were used to conduct a sensitivity analysis. Some valuable lessons were learned and these are presented to assist and guide researchers who wish to use similar methods in future.

Relevance for Practice: Ultimately, good qualitative evidence synthesis will provide practitioners and policy makers with significant information that will guide decision making on many aspects of clinical practice. The example provided explored how people with dementia are cared for acute settings.

WHAT DOES THIS PAPER CONTRIBUTE TO THE WIDER GLOBAL CLINICAL COMMUNITY?

- Qualitative evidence synthesis is valuable for policy development and to guide practitioners in clinical settings
- The query tools within NVivo can facilitate sensitivity analysis to check the impact of the findings from reports deemed of a lesser quality
- It can be concluded that NVivo is suitable for framework synthesis and works well for teams working on qualitative evidence synthesis

KEY WORDS

Dementia, framework synthesis, NVivo, qualitative evidence synthesis, sensitivity analysis

AIM

In Nursing, many qualitative studies have been conducted to generate a knowledge base related to health and illness experiences. Traditionally nursing has been reluctant to accept that knowledge derived from patterns in larger populations is inherently better than meaningful understanding gained from smaller qualitative studies (Thorne 2009). It is now being recognised that evidence-based knowledge is needed to support policy and practice development. Qualitative studies can be very context-specific making it difficult to draw inferences from them to guide practice. Research synthesis can be particularly useful for overcoming this challenge and providing the evidence needed.

Qualitative Evidence Synthesis (QES) is a process of reviewing and systematically integrating the findings of qualitative research into a meaningful and usable report (Thorne *et al.* 2004, Sandelowski & Barroso 2007). The primary aim is to synthesise and interpret isolated, qualitative findings to inform healthcare policy and improve patient care (Finfgeld 2003, Thorne 2009). Proponents of qualitative synthesis believe that this approach presents the complexities of human experiences in a way that is recognisable to the evidence-based community (Thorne 2009). Thomas and Harden (2009) identify that users of systematic reviews are becoming increasingly interested in the answers that only qualitative research can provide.

QES has relevance in nursing as it provides an important opportunity to bring together knowledge and without it, qualitative research research findings may remain isolated and disconnected (Britten *et al.* 2002, Walsh & Downe 2005). In nursing, synthesis can lead to new conceptualisations about nursing care in specific care settings with specific patient populations (Thorne *et al.* 2004). Synthesis has an important role in developing a body of nursing knowledge in areas that require an understanding of multifaceted human interactions.

The aim of this article is to share an example of qualitative synthesis in nursing research. It provides an overview of QES and focuses on one approach, framework synthesis, which was used to conduct the review undertaken. An overview of the review, health care staffs' experiences and perceptions of caring for people with dementia in acute hospital settings is outlined. This review used QSR NVivo software to manage each stage of the synthesis process. No other reports could be identified that provided a detailed account of how NVivo can manage QES from screening to synthesis and therefore it was considered important to share the approach that was taken and some of the benefits and challenges encountered. The methods for using NVivo in the different stages of QES are discussed in terms of: screening, data extraction, synthesis and quality appraisal. These insights could guide and encourage other researchers in its use in managing evidence synthesis.

BACKGROUND

QES is a rapidly growing field in research responding to recognition for more insight into complex human interactions, particularly within Randomised Controlled Trials (RCTs) and intervention research (Thomas *et al.* 2004). Qualitative synthesis was first suggested by Noblit and Hare (1988). Their approach known as meta-ethnography can be used, not just for ethnography but, across different types of qualitative research. The key strategy is to identify concepts from studies and translate them into one another (Thomas & Harden 2008). Within this approach there is an important emphasis on interpretation, however synthesis must 'go beyond' the original findings to present novel understanding (Thorne *et al.* 2004, Thomas & Harden 2008). The aim should not be to simplify a number of qualitative findings, but rather to retain differences and highlight complexities (Thorne *et al.* 2004).

A number of approaches to QES have emerged since the conception of meta-ethnography. These approaches represent "a family of methodological approaches to developing new knowledge based on rigorous analysis of existing qualitative findings" (Thorne *et al.* 2004, p.1343). Examples include: Critical Interpretive Synthesis (CIS), meta-study, Grounded Theory, thematic synthesis and framework synthesis (Noyes *et al.* 2008, Barnett-Page & Thomas, 2009, Finfgeld-Connett & Johnson 2013). Each of these approaches have particular strategies for synthesising the findings of qualitative research. Framework synthesis, originated from framework analysis as described by Ritchie and Spencer (1994). Framework analysis is becoming more commonly recognised as an important synthesis technique (Dixon-Woods 2011). It is has been adapted and termed framework synthesis (Carroll *et al.* 2011, Carroll *et al.* 2013). Framework synthesis is gaining recognition as a systematic synthesis approach that is pragmatic and facilitates team working with complex data. For this reason it was considered a suitable choice for this project.

DESIGN

This is a discursive paper that aims to critically review qualitative evidence synthesis methods and provide guidance for researchers intending to conduct QES on topics that are of clinical relevance.

Conducting QES in a high quality manner ensures its potential to inform clinical and healthcare policy.

METHOD

Framework synthesis is a pragmatic approach to synthesis (Carroll *et al.* 2011) that identifies commonalities and differences in qualitative data, thereby seeking to draw explanations and descriptions around themes (Ward *et al.* 2013). A key difference between framework synthesis and some of the other approaches described above is that, in framework synthesis, a conceptual framework is used to identify *a priori* themes (Carroll *et al.* 2011). This framework is often built from existing knowledge of the topic area, though it can be a pre-existing framework if a suitable framework is extant, and is used to guide and structure the synthesis. Furthermore, if additional concepts emerge during synthesis that do not translate to the existing themes, thematic synthesis is also then undertaken to build on to the existing framework (Carroll *et al.* 2011). On completion, a new model emerges, developed from the existing conceptual framework and encompassing the new concepts and theories (Carroll *et al.* 2011).

The framework approach is flexible and can be adapted to many qualitative approaches (Gale *et al.* 2013). It is a structured approach with clear steps to follow, making it useful for multiple researchers and, therefore, applicable to QES. The framework approach is being recognised as rigorous and systematic in qualitative analysis and synthesis (Ward *et al.* 2013). The findings from the framework approach can be clearly viewed and conclusions and recommendations can be drawn in a straightforward way to inform policy (Johnston *et al.* 2011).

The synthesis example

The synthesis example discussed in this article explored the experiences and perceptions of health-care staff when caring for people with dementia in acute hospital settings. The prevalence of dementia is increasing and, as a result, it is estimated that one quarter of people accessing acute services are likely to have dementia (Alzheimer's Society 2009, Cahill *et al.* 2012). The person with dementia has specific care needs in the acute setting, and while many initiatives are recommended and described in the literature, there is insufficient evidence of their effectiveness (BLINDED, under review). The aim of this review was to synthesise understandings of how staff experience and perceive how they care for people with dementia in acute settings, to uncover current practices, elements of good care, and challenges to appropriate care (BLINDED, under review). This understanding can inform policy development and further research.

For quality purposes, Oliver *et al.* (2012) recommends both a review team and an advisory group for ensuring the appropriate and rigorous conduct of qualitative synthesis. The review team is responsible for the ongoing conduct of the review. Ideally, the team should include individuals with expertise in qualitative research and subject area expertise (Lloyd Jones 2004). The review team in the example review consisted of individuals with topic expertise in dementia research, and methodological expertise in qualitative research. An advisory group can be established also to provide methodological and topic area expertise, with potential international perspectives (EPPI-Centre 2010). In this review, the advisory team included an established expert in dementia care, an expert in QES, and an expert in QSR International's NVivo 10 qualitative data analysis software.

The review adopted framework synthesis described earlier. The conceptual framework that structured the synthesis encompasses four major elements: **Valuing**, **Individualised**, **Perspective** (of the person) and **Social and psychological** (VIPS). The VIPS framework was developed to provide guidance on how the concept of person-centeredness can be applied to caring for people with dementia (Brooker 2007, 2016). It was therefore considered appropriate for guiding the synthesis

exploring how people for dementia are cared for in the acute setting. The findings from this synthesis are presented in another paper (BLINDED, under review).

Overview of NVivo in QES

Qualitative synthesis involves handling large volumes of data and there needs to be an effective system for managing search results, references, decisions regarding inclusion and exclusion, managing copies of research reports and collating and synthesising data (Brunton & Thomas 2012). An electronic database is needed for managing the search strategy, removing duplicates and storing the references (Brunton & Thomas 2012). EndNote is a commonly used database for this purpose. In addition, Computer Assisted Qualitative Data Analysis Software (CAQDAS), such as NVivo, can be used to manage data analysis and synthesis (Thomas & Harden 2008, Howell Major & Savin-Boden 2010). CAQDAS has been developed to assist in the handling, storage and management of data (Bringer *et al.* 2004, MacMillan & Koenig 2004, Silverman 2010). However, it must be remembered that the software is incapable of understanding text and cannot replace the analytical skills of the research team (Bringer *et al.* 2004, Lathlean 2010). There are many functions in NVivo that can facilitate synthesis with a team of researchers. Table 1 outline some of these key functions, their purpose within NVivo and how they were applied in this QES. The application of these functions is also described under the headings of the synthesis process: screening, data extraction, synthesis and critical appraisal. This allows the reader to consider how NVivo could be used and gain some insight from the experiences outline in this paper.

NVivo Functions	Purpose	Application in this Synthesis
Cases	On import, each new data record is assigned to a case (Bazeley 2007). Cases act as the unit of analysis and observation.	Each publication represented a case in this QES. The case node stored the text from the publication and was linked to the metadata associated with the case such as year of publication or type of journal for example.
Sets	Sets act as shortcuts, grouping documents together without merging or combining them (Bazeley 2007).	In this synthesis, publications were grouped during each stage of the process such as title review, abstract review and full read to allow the team to easily work with subsets of publications
Attributes/ Classifications	Attributes are a record of information known about the case, but managed separately from the text generated by the case (Bazeley 2007).	In this study, attributes comprised the metadata linked to the publication along with customised additional attributes, for example, which researcher had screened the publication, and recording the outcomes of each review. Linking attributes allowed the data to be filtered which is key to any synthesis process.
Nodes	Nodes provide the storage areas in NVivo for references to coded text (Bazeley 2007). Node is an NVivo term for what would be more commonly referred to in research as codes signifying themes and sub-themes.	In this synthesis, nodes acted a repository for textual segments which, in this case, represent units of meaning drawn from the synthesised literature (Di Gregorio 2000). Nodes are malleable and behave like both documents and folders. They are documents insofar as they contain text from multiple sources and folders in that they can be organised into a hierarchical thematic structure (QDATRAINING 2013). This was critical to structure the data within the theoretical framework (VIPS).
Queries	Query tools allow researchers to ask questions of the data. Running a query locates all references that meet the criteria of your query. Running queries allows the researcher to audit findings and check that propositions made are grounded in the data (Bassett 2009, Silverman 2010, Bergin 2011, Houghton <i>et al.</i> , 2013).	In this study, queries were used to track information and re-organise the publications based on query results (Leech & Onwuegbuzie 2011) . For example, queries were used to identify publications that were screened by two reviewers but where they disagreed on whether the publication should be included or excluded. This process allowed the team to revisit a “set” of publications that met this condition and make a final decision on the relevancy of the report.
Matrices	Matrices were used to cross tabulate related information in the NVivo database (Casey <i>et al.</i> 2014).	In this study, matrices were deployed to identify general trends (Sinkovics & Alfoldi 2012). For example, matrices revealed patterns in the data (Bergin 2011) such as cross references the quality of paper determined by the critical appraisal process

NVivo Functions	Purpose	Application in this Synthesis
		against the framework developed during synthesis

Table 1: NVivo functions and their application in QES

Screening and NVivo

A systematic search of the literature was undertaken using pertinent databases: CINAHL, Embase, ETHoS, PsychINFO, Proquest, SCOPUS, Web of Science. The aim was to conduct a comprehensive search using extensive and exhaustive techniques (Lloyd Jones 2004, Sandelowski & Barroso 2007, Finfgeld-Connett 2010). No language or year parameters were set. The systematic search conducted retrieved 692 references. An Endnote library was created to file and manage all of the titles and abstracts. The Endnote library was later imported in to NVivo.

Screening involves identifying research reports suitable for inclusion in the synthesis. There needs to be explicit inclusion and exclusion criteria in order for the review team to screen titles and abstracts, for topical, population, temporal and methodological relevance (Brunton *et al.* 2012). The inclusion/exclusion criteria for this review are illustrated in Table 2. The clarity of these criteria helped to reduce any bias in the screening process (EPPI-Centre 2010).

Included	Excluded
Research Studies	Literature Review and descriptive articles
Include qualitative and mixed methods	Quantitative studies
Acute setting should not be place of residence	Not acute setting. Exclude community, long term settings, and dementia specific settings.
All health care staff working in the defined acute setting	Not acute staff sample. Exclude carers, relatives and PWD
PWD in the opinion of the researcher +/- diagnosis of dementia	Not focused on people with dementia
Includes direct care +/- management of care	Not about Care
Perceptions and experiences	Not perceptions and experiences. Exclude if focus on knowledge, decision making, advanced care directives, detection, diagnosis

Table 2: Inclusion/Exclusion Criteria

Screening took place in two stages. It was agreed in this review that title and abstracts should be screened together, as the titles of qualitative studies can often give only a vague indication of methodology or focus. As a consequence, there were two screening rounds: title and abstract screening; and full text screening.

As there was no established structure for screening in NVivo, a system was created using the “case”, “attributes” and “sets” functions in the software. For the first title and abstract screening round, each of the 692 references (title and abstract) imported from Endnote, were identified as a “case”. Each member of the research team was assigned an attribute and a drop menu allowed them to select whether the case was included, excluded and on what grounds, or unsure. Two team members reviewed each of the 692 references independently. The references were colour coded so that each team member knew which of the 692 they needed to screen, which made the system

more user friendly. When the screening of titles and abstracts was completed by the two independent researchers, results were merged and any disagreements were highlighted using the “set” function. Sets act as shortcuts, grouping documents together without merging or combining them (Bazeley 2007). Each pair of reviewers then met to moderate and achieve consensus on whether a report should remain included or excluded (Sandelowski & Barroso 2007, EPPI-Centre 2010). In some instances, the opinion of a third person was sought when consensus could not be achieved. Following the first title and abstract screening round, 69 reports were included for the next, full-text screening, stage. All of the full-text reports were sourced and imported in to NVivo for the next round of screening. The same inclusion and exclusion criteria were used and each team member repeated the independent screening process with their own drop down menu to allocate a decision regarding the suitability of the report for this specific research question. Consensus was achieved by meeting in person to discuss any discrepancies or disagreements about whether a report should be included or not. At the end of this screening phase, 12 documents, or research reports, based on nine studies, were included for synthesis.

One oversight at this stage was not allocating a hierarchy to the reasons for exclusion. The drop menu permitted the researcher to document whether a report was included or excluded and the reason for exclusion. However, a report may have had a number of reasons for exclusion and the researcher could only select one. For example, it may not have used a qualitative methodology and the sample may not have been drawn from health care staff. Without a clear hierarchy for exclusion, each of the pair of reviewers may have excluded for different reasons, which impacted on traceability. If a similar synthesis was to be conducted using a different sample, for instance people with dementia or their carers, the screening process would have to be repeated.

For the two screening phases, NVivo provided a system for handling a large number of references that could be directly imported from EndNote. It allowed for a systematic screening process, using cases, attributes and sets. Information about who screened any of the 692 references and their

decision was readily available. Any disagreement between team members was clearly visible with the moderated decision alongside. This visibility is crucial for ensuring an accurate audit trail (Houghton *et al.* 2013).

Data Extraction and NVivo

Once screening was complete and the final number of included studies was determined, a process of extracting the data from the reports was needed. A data extraction form provides a standardised method for examining the reports both in terms of the methodology and the study findings. In this review, the data extraction form was created as a word document using tables. It was later imported into NVivo once consensus was achieved. A customised data extraction form was developed that contained all the necessary information for synthesis regarding methodology, sampling, ethics, rigour, data collection and analysis, conclusions and recommendations, and limitations. Quality appraisal, described in detail further on, was conducted simultaneously and was also included on the form. Extraction of the research findings was guided by the VIPS framework as described earlier.

There was also scope to include additional findings as advocated within framework synthesis (Carroll *et al.* 2011).

Data extraction was conducted on each of the 12 research reports by two members of the team independently. Comparisons were made and any inconsistencies in what counted as data were discussed and agreed upon. The final agreed versions of the 12 extraction forms were imported in to NVivo for synthesis. While this was originally considered the most straightforward method to do this, a number of challenges arose from this process. As the forms were completed externally and later imported to NVivo, it was not possible to link the extraction forms to their original cases, thus causing a break in continuity in the audit trail. All decisions were still clearly visible but were not as seamless as they could have been. In addition, the data extraction form used a table format, which caused formatting problems when imported into NVivo. Furthermore, it meant that each pre-identified theme (Valuing, Individualised, Perspective, Social and Psychological) needed to be

manually coded again within NVivo. One alternative at this point would have been to develop a form that was compatible with NVivo and therefore could have been more easily imported and coded automatically by the software. This can be easily achieved by using headings that are recognised by NVivo. The headings and relevant content can be automatically coded once imported in to the software. Another alternative, that the researchers will consider in future, would be to conduct data extraction within NVivo using Nodes. "Nodes" provide storage areas for coded text and act as a repository for evidence about a concept or category (Bazeley 2007). This would mean direct coding from the full text PDF document within NVivo. Critical Appraisal could be conducted in this way also. However, the extraction form was useful in structuring the coding and once it was imported and the nodes were applied, a clear framework for synthesis was in place.

Synthesis and NVivo

Framework Synthesis was used for synthesising the included studies (Carroll *et al.* 2011, 2013). As outlined earlier, the VIPS framework was used to provide the *a priori* themes for synthesis. The framework provided structure, and cohesion throughout the review process, which recognised the importance of the person with dementia as central to the entire process (Brooker 2007, BLINDED, under review). During synthesis, if data emerged that did not translate to the existing themes, thematic synthesis was then undertaken as an interpretive, inductive process (Carroll *et al.* 2011).

Once the data extraction forms had been imported into NVivo, the four main themes, derived from VIPS, became the parent nodes for synthesis. "Nodes" are an NVivo term for what would be more commonly referred to in research literature as codes signifying themes and sub-themes. They are a repository for textual segments which, in this case, represent units of meaning drawn from the synthesised literature. Nodes behave both like documents and folders: documents, insofar as they display the text from several sources, and folders because they are malleable and can be organised

into a hierarchical structure. Hierarchical nodes were used to create the subthemes that encapsulated the experiences and perceptions of staff caring for people with dementia in the acute setting (Appendix 1).

Memos were used to draft the executive summary statements, which eventually formed the final findings in the report. Table 3 depicts the final themes and subthemes that emerged from the synthesis. NVivo facilitated framework synthesis and provided clear audit trail enhancing confidence in the synthesis findings (Houghton *et al.* 2013).

THEMES	SUB-THEMES
VALUING	Pathways of care Culture of care
INDIVIDUALISED	“Pieces of the puzzle” Barriers to person-centred care
PERSPECTIVE	Interactions and impact on other patients The built environment
SOCIAL AND PSYCHOLOGICAL	“Forming relationships” Family involvement

Table 3: VIPS themes and sub-themes

Quality Appraisal and NVivo

Quality appraisal of the research is an essential process in qualitative synthesis. An appraisal guide should be used systematically, but dynamically, in interaction with each report (Sandelowski & Barroso 2007). There is debate within the literature as to whether appraisal should occur for the purpose of excluding lower quality studies, or to provide a filter for mediating the differing strengths of findings included (Noyes *et al.* 2008). On the one hand studies identified as of low methodological quality can still generate new insights and, conversely, some methodologically sound research may

yield superficial findings (Dixon-Woods *et al.* 2005, Gough 2007, Noyes *et al.* 2008, Thorne 2009). In this review, quality appraisal was used simultaneously with data extraction for the purpose of determining the impact of including studies that were deemed of a lesser quality (Thomas & Harden 2008).

The Critical Appraisal Skills Programme (CASP) tool is commonly used to appraise studies in qualitative synthesis (Downe *et al.* 2007, Campbell *et al.* 2011, Valderas *et al.* 2012). The CASP tool was integrated in to the data extraction form and then imported in to NVivo for synthesis. Once imported, a sensitivity analysis was conducted to determine the effect of the quality of each report on the overall synthesis findings (Carroll *et al.* 2011, 2013). Attributes were used again, with a drop down menu, so that each study could be classified as of either higher or of lower quality.

Then, using a matrix query, the density of coding in each theme and subtheme was identified in three categories: for all reports (n=12), the reports of higher quality (n=10) and reports of lower quality (n=2). Matrix-coding queries allow for the comparison of multiple nodes and attributes as a numeric table with shading (Bassett 2009). Table 4 illustrates the matrix coding and shading density for the themes. The shading (dark blue to white) indicates that the higher quality reports and all reports are so similar in their density of coding that the lower quality reports did not skew the findings in any particular direction. The figures refer to the number of coded reports in each. Running more detailed matrix coding on the subthemes (Appendix 2) provided the same information, thus enhancing the confidence in the findings.

THEMES	VALUES	INDIVIDUALISED	PERSPECTIVE (of PWD)	SOCIAL AND PSYCHOLOGICAL
ALL SOURCES	12	12	11	11
HIGH QUALITY	10	10	9	10
LESSER QUALITY	2	2	2	1

Table 4: Matrix coding for themes and quality appraisal

This process within NVivo provided useful illustrations to support and enhance confidence in the synthesis findings. The aim was to confirm the findings rather than to quantify them (Houghton *et al.* 2013), which is why the colour shading was considered important. It must be acknowledged however that CASP is limited to assessing the methodological aspects of the report and does not acknowledge relevance or contribution. Critical appraisal needs to be underpinned by a multi-dimensional concept of quality (Jordan *et al.* 2015). This method of sensitivity analysis within NVivo needs to be further developed to incorporate these study elements.

CONCLUSION

Conducting this review, from screening to synthesis, within NVivo was challenging at times, but the benefits outweighed the obstacles encountered. While there are alternative software applications for undertaking QES (e.g. systematic review software, such as EPPI-Reviewer (2010), and generic CAQDAS software, such as Atlas TI (1999)), the functionality present in NVivo made it a good choice for managing data within a QES. It was possible to maintain an accurate record of all decisions made and the option to question and query the findings in a rigorous manner enhanced the trustworthiness of the review. Reflecting on some of the challenges provides guidance and tips for future researchers intending to use NVivo for qualitative synthesis. Clear communication strategies are needed for teams when such large numbers of reports are being screened through NVivo. Colour coding is useful here. It is recommended that there is consideration of a hierarchy for exclusion so that the process can be easily replicated if another similar review is conducted, for example from a

different participant perspective. At data extraction stage, it is important to ensure the extraction form is compatible with NVivo allowing for easier import and coding. Alternatively, conducting extraction directly within NVivo could be considered, as all full text reports should be available within it. Meaningful sensitivity analysis is possible within NVivo. This needs to be further developed to include consideration of relevance and contribution of the reports. Ultimately, using NVivo provides a robust and pragmatic way to manage the complexities and sometimes nebulous reality of conducting qualitative evidence synthesis.

RELEVANCE TO CLINICAL PRACTICE

Qualitative evidence synthesis has become a widely accepted methodology for presenting evidence in a robust way for the purpose of policy and guideline development. This is critical in clinical settings where policy makers need evidence to support decisions made. In addition, QES reports can act as a repository for practitioners, wishing to access the most relevant and up-to-date evidence on an issue of interest to their practice. It is critical researchers conduct QES in a rigorous and systematic way in order for the findings to be credible. This paper provides a clinically relevant example of how this can be achieved through managing framework synthesis within NVivo software.

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