

## **The paper we needed at the beginning: how to analyse results from the nominal group technique**

### **Abstract**

The nominal group technique (NGT) is a method to elicit healthcare priorities. Yet, there is variability on how to conduct the NGT, and limited guidance on how to analyse a diverse sample of multiple groups. This paper addresses some of this ambiguity, and explores whether different approaches to analysis provide the same outcome/s. Conceptual papers and empirical studies were identified via PubMed and informed an adapted version of the NGT. Twenty-six nominal groups were conducted, which provided in-depth knowledge on how to best conduct this method. Pilot group data was used to compare different analysis methods and to explore how this impacted on reported outcomes. Data analyses for large data-sets are complex; thematic analysis is needed to be able to conduct across group comparisons of participant priorities. Consideration should be given not just to the strength, i.e. sum of votes, or relative importance of the priority, but to the voting frequency, i.e. the popularity of the idea amongst participants; our case study demonstrated that this can affect priority rankings for those ideas with the same score. As a case study, this paper provides practical information on analysis for complex data sets. Researchers need to consider more than one analysis process to ensure that the results truly reflect participant priorities. A priority that has a high score may not necessarily reflect its popularity within the group; the voting frequency may also need to be considered.

## 1 Introduction

The importance of healthcare user's views and priorities is now increasingly recognised, particularly as consumers are more likely to use a service that meets their specific needs. Given the growing emphasis on addressing the rising rates of chronic conditions and providing patient-centred care, policy makers are more likely to seek consumers' healthcare expectations and priorities.

However, opinion varies as to the best method(s) to elicit consumer priorities (Ryan et al. 2001). The methods used include consumer surveys, focus groups, citizen juries, discrete choice experiments and Delphi-like methods, all of which have strengths and weaknesses (Ryan et al. 2001). For example, focus groups can generate more ideas than a single interview, but dominant personalities can influence the discussion (Gallagher et al. 1993), and ideas are not prioritised. Citizen juries allow participants to become informed about a particular topic, but are expensive and time-consuming (Ryan et al. 2001). The Delphi technique provides participant anonymity, but there is a risk of response bias (Ryan et al. 2001). Discrete choice methods can identify attributes of a service that are important to consumers, as well as their relative importance (Naik-Panvelkar et al. 2013), yet are complex in terms of design, and dependent on poorly defined processes for selecting attributes (Hilgsmann et al. 2013).

One method, the Nominal Group Technique (NGT), can explore healthcare priorities (Hutchings and Raine 2006), whilst addressing some of the above limitations. The NGT was developed by Delbecq and Van de Ven (1971) over four decades ago, as a process for '*identifying strategic problems and developing appropriate and innovative programs to solve them.*' The NGT facilitates the generation of ideas in relation to problems, solutions, or both, which are then discussed and ranked in order of priority by individual participants (Gallagher et al. 1993). It also allows comparisons of priorities between different groups, such as health consumers and healthcare professionals, which can then identify divergence in views (Cantrill et al. 1996). The NGT facilitates equal participation and allows all opinions to be respectfully considered (Carney et al. 1996), thereby minimising dominant personalities and focus on one particular viewpoint. Furthermore, the NGT is more likely to reach a clear outcome, providing a sense of

achievement for participants (Harvey and Holmes 2012). Importantly, the NGT requires less time and resources than another consensus method, the Delphi technique (Delbecq et al. 1975).

The NGT has been applied in numerous studies to identify current opinions, or achieve consensus on a healthcare topic. These applications include preferences and views on end-of-life care (Denning et al. 2012), patient-centred healthcare professionalism (Hutchings et al. 2010), priority treatment outcomes (Sanderson et al. 2012), concerns (Miller et al. 2000), or challenges (Dewar et al. 2003) regarding specific chronic conditions, the evaluation of healthcare experiences (Potter et al. 2003) and unmet healthcare needs (Drennan et al. 2007), and to establish guidelines or research priorities (Vella et al. 2000). Participants have included consumers with various chronic conditions, carers, and varied healthcare professionals, such as nurses (Hutchings et al. 2012), doctors (Vella et al. 2000) and pharmacists (Hutchings et al. 2010).

Although there is considerable consensus on how to conduct certain aspects of the NGT, there is still some variability in its application. As most studies have involved small numbers, i.e. between one and five groups (Bissell et al. 2000; Denning et al. 2012; Gastelurrutia et al. 2009; Hilgsmann et al. 2013; Miller et al. 2000; Sanderson et al. 2012; Tully and Cantrill 2002; Vella et al. 2000), there is limited information on how to conduct and analyse a study with larger data sets. Our study helps to bridge this gap by exploring data analysis methods for 26 nominal groups (15 consumer and carer groups, 11 healthcare professional groups; participant range 2-14 per group). The focus of our study was the potential role of community pharmacy in the management of chronic disease. The large number of groups was conducted to ensure diversity with respect to participant demographics, i.e. location, cultural diversity and the chronic condition/s experienced. However, given that limited guidance existed about how to conduct data analyses across such a large number of groups, we were faced with questions about how to collapse and compare the findings. We also questioned whether different approaches to analysis would provide the same outcome/s.

The aim of this paper is to provide an overview of the NGT method as it has been applied in healthcare, and to illustrate some nuances of the NGT approach using a case study. Our intent is to provide

recommendations on the analysis of multi-group NGT and address some of the ambiguity surrounding its use. The paper begins with a description of NGT literature, and our specific adaptation of this method. We then compare the different data analyses options and related outcomes using our data (pilot group 2) as a case study.

## **2 Method**

### **2.1 Literature Review**

A literature search for conceptual papers and empirical studies utilising the NGT was conducted using PubMed as the primary database; other articles were searched via pharmacy specific journals and reviewing the reference list of obtained articles. Included articles referred to, or involved the use of the NGT in the healthcare sector, and were written in English. The studies described here were chosen to reflect the diversity of nominal group procedures and analysis within healthcare (see Supplementary material Tables 1 & 2) (Allen et al. 2004; Bartunek and Murningham 1984; Carney et al. 1996; Claxton et al. 1980; Gallagher et al. 1993; Jones and Hunter 1995; Potter et al. 2004; Sink 1983; Bissell et al. 2000; Dening et al. 2012; Dewar et al. 2003; Gastelurrutia et al. 2009; Hiligsmann et al. 2013; Hutchings et al. 2012; Miller et al. 2000; Potter et al. 2003; Sanderson et al. 2012; Tully and Cantrill 2002; Vella et al. 2000; Aspinall et al. 2006; Kristofco et al. 2005). Despite the diversity in application, there was general consensus on four core NGT phases: *silent generation*, *round robin*, *clarification* and *ranking*. These four stages were used in the current study.

### **2.2 NGT process**

We applied an adapted version of the NGT when exploratory research highlighted that many consumers are poorly informed users, with limited awareness of community pharmacy services (McMillan et al. 2014). Therefore, a pre-elicitation technique (Gonzales and Leroy 2011) was used; participants were sent an information guide describing current and potential pharmacy services prior to attending a group. To inform participants of the aim and the importance of the session, the two questions to be posed to the groups were also provided. Contrary to most nominal group questions which are problem focused (Bissell et al. 2000; Dewar et al. 2003; Hutchings et al. 2012; Miller et al. 2000; Tully and Cantrill 2002; Vella et

al. 2000), the study questions intended to get participants to think about their ideal healthcare (question 1); and pharmacy service (question 2), i.e. *“imagine your pharmacy in the future and what service could they offer to help you meet you’re your individual health goals.”*

The phrasing of these questions built on an appreciative inquiry approach (Gonzales and Leroy 2011), which can be used when participants find it challenging to articulate their preferences due to a lack of technical (e.g. pharmacy) knowledge.(McMillan et al. 2014) This approach directs participants to adopt a positive outlook, think beyond fixing problems and into the future, thereby promoting greater engagement and creativity (Gonzales and Leroy 2011). To further facilitate this approach, participants were asked to describe ‘the best of what is,’(Gonzales and Leroy 2011) in this case, a positive experience with a healthcare professional or service.

### 2.2.1 Introduction to the process

Our experience with 26 groups reinforced the need to train three facilitators to adopt distinct role/s; a primary facilitator to lead and provide directions to the group, one to take field notes, and the other to write participant ideas on a whiteboard (Carney et al. 1996). Upon consent, all groups were recorded, transcribed (Potter et al. 2004) and quality checked.

Like any other methodology where participant consent is required, providing an overview of the study and objective/s is essential, as well as re-inforcing the value of their individual contribution (Delbecq et al. 1975). The majority of papers (Claxton et al. 1980; Sink 1983; Gallagher et al. 1993; Carney et al. 1996; Dewar et al. 2003; Potter et al. 2003; Potter et al. 2004; Kristofco et al. 2005; Hiligsmann et al. 2013) briefly mentioned or described an introductory step that was useful prior to starting the nominal group. Three papers (Hiligsmann et al. 2013; Carney et al. 1996; Potter et al. 2004) described explaining the entire group process, or steps involved, in this stage. However, we found that it was less confusing to provide a brief study overview and then clarify the procedure as the group progressed through each stage. Although this is not explicitly stated by Delbecq et al. (1975) their worked example of the NGT process also provided in-depth facilitator instructions for each stage.

In general, one (Bissell et al. 2000; Dening et al. 2012; Gastelurrutia et al. 2009; Hiligsmann et al. 2013; Miller et al. 2000; Sanderson et al. 2012; Tully and Cantrill 2002; Aspinall et al. 2006; Kristofco et al. 2005) or two questions (Dewar et al. 2003; Hutchings et al. 2012; Potter et al. 2003) are posed per group, with each question usually considered as a separate nominal group process. We found it useful to include two questions to provide broader contextual discussion and promote familiarity with the group process prior to tackling the primary question of interest. This also enabled us to determine the extent to which specific demands of pharmacy could be distinguished from the broader health system.

### *2.2.2 Silent Generation*

Participants are given up to 5 (Dewar et al. 2003; Aspinall et al. 2006; Kristofco et al. 2005), 10 (Dening et al. 2012; Miller et al. 2000; Potter et al. 2004; Carney et al. 1996), 15 (Gallagher et al. 1993; Sink 1983), and 20 minutes (Claxton et al. 1980) to consider the question. During this time, participants are instructed to individually record, in silence, as many ideas as possible. Any discussion should be avoided (Delbecq et al. 1975); however, the literature varies slightly as to the role of the facilitator at this stage. Delbecq et al. (1975) recommended that facilitators model participant behaviour, i.e. to write down and share their own ideas. The majority of papers emphasised the need for the facilitator to simply maintain silence. Whilst undertaking our nominal groups, we realised that although the silent generation phase seemed straight forward, participants with low health knowledge, complex health conditions or poor literacy experienced considerable difficulties. Consequently, participants were advised that ideas need not be written down but could be simply thought about. Given that our target population was people with chronic condition/s, of which many had complex or multiple conditions, our facilitators chose to sit quietly and assist participants if they required help with writing (Tuffrey-Wijne et al. 2007). A variation on this model would be to work in small groups to generate ideas, making sure that each participant was able to contribute.

### *2.2.3 Round Robin*

This phase can last from 15 (Dening et al. 2012) to 25 (Sink 1983) or 30 minutes (Potter et al. 2004), providing everyone the opportunity to contribute one idea at a time until all ideas are exhausted. Delbecq

et al. (1975) advised facilitators to encourage people to add new ideas after listening to other comments, but only when it is their individual turn. Discussion during idea-presentation is generally not recommended (Delbecq et al. 1975). However, we found some discussion to be culturally appropriate for particular groups. For example, for Aboriginal and Torres Strait Islander people, discussion helped to create a safe space for participants. Therefore, the round robin and clarification phase were conducted simultaneously for some groups.

There is consensus in the literature that ideas should be recorded verbatim on a whiteboard or flipchart for participants to see. However, there are differences of opinion with respect to the facilitator's role at this stage. For instance, Delbecq et al. (1975) suggested that the facilitator contribute ideas in the same way as participants. We chose not to do this, fearing that it may bias participant responses.

#### *2.2.4 Clarification*

This phase ensures that participants understand the meaning of each idea, thus enabling individuals to make an informed decision when ranking their priorities. The ambiguity about this phase relates to whether ideas can be grouped or eliminated. Some papers document the grouping of duplicate (Carney et al. 1996) or similar ideas (Dewar et al. 2003; Potter et al. 2004; Jones and Hunter 1995; Hutchings et al. 2012; Sink 1983), the inclusion (Gallagher et al. 1993; Potter et al. 2004) or deletion of items or duplications (Claxton et al. 1980; Hutchings et al. 2012; Sink 1983), or both, i.e. inclusion and exclusion of items (Aspinal et al. 2006), or all three, i.e. inclusion, exclusion and grouping of items (Bissell et al. 2000). Other studies discussed the alteration of ideas (Vella et al. 2000; Allen et al. 2004), or generation of themes (Denning et al. 2012). The study by Sanderson et al. (2012) did not involve a clarification phase, but allowed participants to present a rationale for their chosen priority. Another study asked groups to pass their suggested items to other groups for feedback, which enabled participants to revise and regroup items (Bartunek and Murnighan 1984).

Since grouping similar ideas and removing duplicates can be more complicated (Sink 1983), the literature indicates that this phase should be allocated the most time, i.e. 20 to 30 minutes (Sink 1983; Gallagher et

al. 1993). According to Delbecq et al. (1975), the facilitator's role in this stage should be to pace the group to avoid argument, and ensure that all ideas are discussed. However, we found that this phase needed to be adapted if there was participant confusion, and that amalgamating similar ideas was contingent on group consensus. Furthermore, not all ideas on the board needed to be grouped, even if they appear to be similar. Carney et al. (1996) suggested that attempts to condense ideas into broader themes should be resisted. In our study, the clarification phase was difficult, but resulted in a more succinct list of ideas for easier participant ranking. We also found that the primary facilitator needed to clarify to participants that although they may not agree with a particular idea, the purpose of this phase was only to clarify the ideas; the next stage would allow participants to vote on their preferred ideas. In our study, participants appreciated the use of one large whiteboard where one half of the board listed the round robin (original) ideas, and the other half contained the clarified ideas in a different coloured font.

#### 2.2.5 Ranking

There are a variety of ways to conduct the ranking phase of the NGT. For example, participants could rank a number of ideas in terms of importance (Carney et al. 1996; Denning et al. 2012; Miller et al. 2000; Dewar et al. 2003; Potter et al. 2004; Sink 1983; Tully and Cantrill 2002; Gastelurrutia et al. 2009; Drennan et al. 2007), or could use a two-step process comprising secondary ranking (Gallagher et al. 1993; Hiligsmann et al. 2013; Allen et al. 2004; Bartunek and Murningham 1984; Hutchings et al. 2012; Jones and Hunter 1995; Claxton et al. 1980; Sanderson et al. 2012; Aspinal et al. 2006; Kristofco et al. 2005). The latter approach extends first ranking discussions to include either individual re-ranking (Hiligsmann et al. 2013; Claxton et al. 1980; Hutchings et al. 2012; Jones and Hunter 1995; Kristofco et al. 2005; Aspinal et al. 2006), priority ranking, i.e. 0-100 (Gallagher et al. 1993), re-ranking of a secondary questionnaire, i.e. if a questionnaire was used initially to obtain priorities (Allen et al. 2004), or public voting (Bartunek and Murningham 1984). Delbecq et al. (1975) suggested that public voting could instigate social pressure to conform to the norm, so proposed a more private voting process. Because of time constraints in our study (our groups took up to three hours for consumers), we decided that a secondary ranking process by participants was not feasible.



Participants are asked to select and then rank their top ideas, which can range from 5 (Carney et al. 1996; Denning et al. 2012; Sanderson et al. 2012; Drennan et al. 2007; Dewar et al. 2003; Miller et al. 2000), 8 (Claxton et al. 1980) and 10 or more options (Gallagher et al. 1993; Hiligsmann et al. 2013). This phase can take up to 10 minutes (Denning et al. 2012). Although our original intent was to have participants' rank 10 items, pilot group 1 participants indicated that this process was too difficult. Pilot group 2 confirmed that ranking five items was more manageable. Some participants still expressed difficulty in choosing only five items because they thought all ideas were important. Thus, it was essential for facilitators to explain that all ideas were considered important and would be taken into consideration. Participants were first asked to individually select their top five ideas from the entire set of generated ideas. They were then asked to rank those five ideas, with five points allocated to their top priority and one point to their lowest priority. To avoid errors, we provided participants with a ranking sheet for recording their votes. These unidentifiable ranking sheets allowed participants a relatively private method of allocating their votes. The ranking process was completed individually, without group discussion.

In the initial groups, some participants allocated the same points for more than one idea, and we found that explaining the ranking process step-by-step and giving them sufficient time to vote minimised these mistakes. If further instruction was required, we provided similar advice given by Delbecq et al. (1975): *"From your chosen top five, please allocate a mark of 5 for the one most important to you"* (followed by time to vote). We then instructed them: *"From the four choices remaining, please allocate a mark of 1 for the item least important to you,"* (followed by time to vote) and so on. One facilitator quality checked the ranking sheets as they were handed in.

### 2.3 Data management

There was minimal reference to data management in the NGT literature. As our study involved a large number of groups, data management was particularly important to ensure a streamlined analysis process. We utilised Microsoft Office® Excel (v14) spread sheets to record the scores allocated by each participant and the ranked priorities for each group, i.e. the raw data. We calculated the sum of the scores for each

idea, and noted whether the idea was in the top five, i.e. its ranked priority (Table 1). This allowed for immediate reporting back of the results to participants.

### 3.0 Analysis and Results

Data analysis was ongoing and an overview of the process used in our study is provided in Figure 1. This involved i) analysis of the raw data, ii) thematic analysis of the raw data, iii) analysis of secondary coded data, and iv) qualitative analysis. All stages will be described in further detail below.

#### 3.1 Analysis of the raw data

Initial review of the raw data (i.e. the original participant data) from the Excel spread sheets identified any anomalies or nuances within the data. For instance, in pilot group 2, two ideas (*24-hour access* and *health information*) obtained the same score, i.e. a score of 14 (Table 1). This process is known as the summing of votes (Denning et al. 2012; Sanderson et al. 2012; Tully and Cantrill 2002) or the strength of vote score (Sink 1983). The above result was also reflected by the relative importance (Gastelurrutia et al. 2009), i.e. the proportion (%) of all scores in the top five, which was calculated using the following equation: (score achieved for the item)/(maximum possible score) x 100. Both of these ideas had the same relative importance, and subsequently, the same ranked priority list obtained by the sum of scores (Table 1). This situation raised the question as to how similarly ranked priorities should be handled. In this case, the number of votes (Sink 1983), i.e. frequency, or the number of times a particular idea was voted for (Miller et al. 2000; Dewar et al. 2003) by participants was useful; a high score does not necessarily reflect that an idea was frequently chosen by participants to be in their top five priorities. More participants, i.e. five out of six participants, voted for *health information* rather than *24-hour access*, i.e. four out of six participants, therefore making it a slightly greater priority (Table 1). Subsequently, the raw data was organised with respect to the sum (or the relative importance) and frequency of votes, meaning that if two items had an equal score, then the item with the highest frequency of votes was prioritised first. However, our 26 nominal groups generated a large number of ideas (question 1 = 203 ideas; question 2 = 276 ideas), and ranked priorities (question 1 = 83 priorities; question 2 = 130 priorities), posing a challenge in terms of how best to compare and present this large data set.

### 3.2 Thematic analysis of the raw data

Researchers have thematically analysed the raw data from groups of ten or more (Dewar et al. 2003; Aspinall et al. 2006). Aspinall et al. (2006) indicated that this was done ‘to facilitate cross-group comparison of data.’ It was difficult to compare raw data across the groups in our study because of the diversity in group composition and approach to the task. Each group generated multiple ideas, and grouped those ideas differently in the clarification phase. For example, the ideas related to ‘Access’ were described in numerous ways, including: *drive-thru*, *less restricted medication access*, *24-hour pharmacy*, *environment*, *more on duty-pharmacists* and *accessibility*. Furthermore, some ideas may not have been grouped if there was no agreement between participants during the clarification process. Alternatively, if participants felt that one idea fitted across numerous clusters, it was not grouped. Thus, to manage this diversity, a thematic framework was developed.

Thematic analysis has been conducted in many different ways in the NGT literature. Aspinall et al. (2006) described a process by which two researchers independently grouped similar ideas and then met to agree on the corresponding themes. Hutchings et al. (2012) followed a process similar to Aspinall et al. (2006), but a third researcher amalgamated the themes produced by the first two researchers. Dewar et al. described a more complex process whereby four researchers individually developed a classification framework, which was then standardised via discussions to reach consensus (2003). The standardised framework was applied to the nominal group data by two researchers, and checked by a third researcher (Dewar et al. 2003).

We adapted the more complex process (Dewar et al. 2003) further. One researcher independently reviewed the priorities for all 26 nominal groups using the raw data, and generated an initial framework which was reviewed and clarified by another researcher. Further discussion resulted in 23 agreed themes. Four researchers deliberated over the 23 themes in order to develop higher order themes and subthemes, i.e. a secondary coding framework. For quality control purposes, a workshop was held with the entire research team to review the secondary coding framework, which resulted in 12 over-arching themes. This

final framework was applied to the raw nominal group data by four independent researchers, who then met to discuss and reach consensus for the secondary coded data, i.e. themes for all raw data. Subsequently, additional analysis of the secondary coded data was conducted to allow comparative analysis between groups.

### 3.3 Analysis of secondary coded data

To address the challenges of equal scores as described above, and the ambiguity surrounding the NGT data analysis process, we decided to trial two analysis processes with the secondary coded data; analysis of only the top five themes (option A), and analysis of all the themes generated by the group, i.e. beyond the top five themes (option B). These methods were chosen to be able to compare across groups rather than as one complete data-set (i.e. combining the data for all 26 groups).

#### 3.3.1 Analysis of the top five themes only (option A)

Summing the votes allocated to each idea is the most common way to analyse and describe nominal group data (Hilgsmann et al. 2013; Denning et al. 2012; Sanderson et al. 2012; Miller et al. 2000; Dewar et al. 2003; Tully and Cantrill 2002). However, given the number of groups included in our study, variation in group size and the diversity of the themes identified during discussions, it was difficult to compare the relative importance of particular themes across groups.

For this method of analysis, the overall priority score for each theme was calculated, i.e. the top priority received five points, the second received four points etc. However, as can be seen from the pilot data (Table 2), themes can arise more than once in a group. For example, 'Access' was a higher order theme that encompassed the following two ideas that were raised in the pilot group; *24-hour access* and *environment*. As 'Access' was the third (equal to 'Consumer information or education') and fifth priority for this group, this provided an overall priority score of four (i.e. three points for third and one point for fifth priority). This resulted in the following priority list in descending order: 'Continuity and coordination of care', 'Quality of service delivery' and 'Access' as equal second priority and 'Consumer information or education' as fourth priority (Table 2).

Next, the voting frequency for the top five themes was calculated to determine how many times a particular theme was voted for, and subsequently, how popular the idea was amongst participants. This style of analysis accommodated the fact that one participant could have voted for two different ideas which were then coded into the same higher order theme, meaning it appeared twice. For example, four participants voted for *24-hour access* and four voted for *environment*, and both were coded into the higher order theme 'Access.' Therefore, 'Access' as the secondary code was voted for eight times compared to 'Quality of service delivery' which was voted for four times (Table 2). When considering this additional information, the priority list changed again: 'Continuity and coordination of care,' 'Access,' 'Quality of service delivery,' and 'Consumer education and information.' The voting frequency was useful to differentiate between the two equal priorities seen via the sum of votes (i.e. 'Quality of service delivery' and 'Access').

### 3.3.2 Analysis of all the themes generated by the group (option B)

The second analysis process that we trialed focused on all the results generated by the group; beyond the original top five priorities. The total score for each theme generated by the group was calculated, i.e. the sum of votes, resulting in the following priority list: 'Continuity and coordination of care,' 'Access,' 'Quality of service delivery,' 'Consumer information or education' and 'Affordability' (Table 2). The same priority list was achieved by calculating the relative importance of the themes. As there were no similar scores or proportions, there was no need to review the number of votes.

Therefore, there was a difference in priority lists between the two analysis methods for the secondary coded data. Option B, reviewing all data resulted in another theme ('Affordability') included into the priority list. This raises the question of which secondary analysis method best represents the data? We believe that the secondary coding of all themes (option B) is better than secondary coding of the top five themes only by awarding a score of five to the top scoring theme, four to the next highest score and so on (option A). Option A reflects a practical approach, yet it only considers high scoring ideas and not when related ideas (i.e. coded under the same theme) appear elsewhere in group preferences. Option B accounts

for when a common theme was considered a priority by any participant, even though they may prioritise specific aspects of that theme (e.g. *environment* vs. *24-hour access*). This analysis approach reflects the predominance of a theme more accurately. Although calculating the relative importance provided the same ranked list as summing the votes in option B, it can be used to demonstrate how important a theme is within a group (i.e. the total value placed on that theme by participants).

The median, inter-quartile range (IQR) (Hutchings et al. 2012; Aspinal et al. 2006), mean and standard deviation of votes (Kristofco et al. 2005) were also calculated for the pilot group data. However, this descriptive data cannot be used to compare preferences across groups and we have not presented it here.

A method to identify the overall priority list when combining data from multiple groups into one complete sample has been described elsewhere (Van Breda A.D. 2005). Van Breda (2005) considered the average scores for the raw data, the average scores for the themes and the frequency of themes (i.e. how many times a theme appeared in the top five and how often an idea was raised and coded under the same theme). Our paper will not go into detail using Van Breda's (2005) recommendations as our analysis was focused on group comparisons to reveal nuances in priorities across a diverse sample. However, when comparing our method of analysis to Van Breda's (2005) method for individual groups, the same themes were identified in the top five, although in slightly different priority orders; we conducted this quality check for three of our groups. Therefore, we suggest that Van Breda's (2005) more complex method be used as a sensitivity analysis or if analysis of combined data is an objective.

### 3.4 Qualitative analysis

Transcripts were also analysed to provide additional context, such as underlying rationale for individual ideas and related discussion undertaken in the clarification phase. The researchers read over the transcripts and applied the secondary coding framework, i.e. the 12 overarching themes and their subthemes, using NVivo 10<sup>®</sup>.

## 4.0 Discussion and recommendations

The NGT is a useful method for eliciting priorities in healthcare. However, our study demonstrates that conclusions drawn from the NGT about priorities may change slightly depending on the method of analysis used. For researchers conducting multiple nominal groups who wish to compare *across* groups, we recommend using the secondary coding and subsequent analysis process for all themes (option B) as explained in this paper. Otherwise, if wanting to combine the entire data set into one group, then Van Breda's (2005) process is a possible alternative.

Nominal group analysis should consider themes across the entire group rather than restrict this to the top five priorities. This allows researchers to look at the importance of a theme in the context of the total possible score for the group. It also allows exploration of nuances in preferences between different aspects of the same construct (e.g. 'Access'). It is conceivable that this approach would inform policy makers on the themes / issues that are of particular importance whilst providing insight that allows targeted improvement (e.g. *24-hour access*). When analysing data, if themes have equal relative importance, the voting frequency then needs to be considered. This latter process will not affect those priorities that are clearly differentiated. Furthermore, consideration of not just the themes that were highly valued with respect to score, but those valued with respect to a higher frequency of votes, may provide a more true reflection of priorities.

Qualitative data should be used to support and contextualise the justification of priorities identified through the quantitative analysis, and also inform targeted policy change. For NGT studies involving multiple and diverse groups, secondary coding of the priorities according to higher-order themes can assist with cross-group analysis. Furthermore, our coding framework, whilst needed to conduct across group analyses, changed group priorities; there were differences between raw and secondary coded priority lists in our case example. It is therefore important that researchers develop a rigorous process with respect to thematic analysis in order to remain true to the data and therefore, participant views.

With respect to the group process, we found that this can (and needs to) be adapted according to participant needs, without comprising research integrity. For example, facilitators may need to provide

further assistance to participants with lower literacy levels or health conditions, thus ensuring that their voices are heard. Furthermore, the creation of a safe space that is culturally appropriate needs to be supported. We also recommend having a minimum of three facilitators for group and data management purposes, and a maximum of seven participants per group. This group size makes the process easier for facilitators to manage or if participants need extra assistance.

The analysis of nominal groups is complex, and researchers need to reflect on the analysis strategies to employ in order to truly reflect participant priorities and reveal subtle nuances in these priorities that can inform effective utilisation of health resource. Only then can healthcare professionals, organisations and policy makers obtain a full understanding of the needs of health consumers.



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### **Ethics approval**

Ethics approval was obtained from Griffith University Human Research Ethics Committee (PHM/12/11/HREC). Informed consent was obtained from all participants who were involved in the nominal groups.

### **Conflicts of interest**

None.

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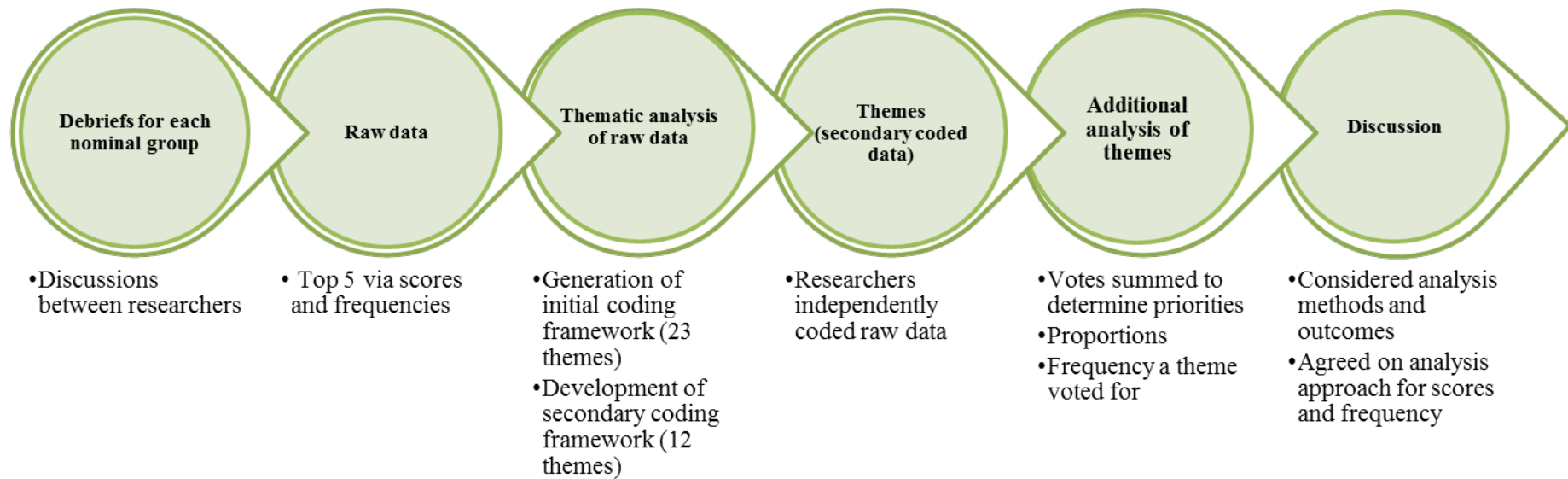
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**Figure 1: The study (quantitative) analysis process**

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**Table 1: Excel spread sheet for pilot group (raw data; question 2)**

Ideas (after clarification phase)	Priorities (scores from each participant)						Sum of scores (for each idea)	Ranked priority (via scores)	Relative importance (%)*	Ranked priority (via %)	Frequency of voting (for each idea)	Ranked priority (via scores & frequency)
	1	2	3	4	5	6						
Care coordination (e.g. referrals)	5	5	5	4	5		24	#1	26.7	#1	5	#1
Professional competence (e.g. don't give generics)	4	2	4			5	15	#2	16.7	#2	4	#2
Health information	2	4		3	3	2	14	#3	15.6	#3	5	#3
24-hour access			3	5	2	4	14	#3	15.6	#3	4	#4
Environment (e.g. private space, friendly service, chairs)	1		1		4	1	7	#5	7.8	#5	4	#5
Consistent medication pricing	3					3	6				2	
Follow up (e.g. Skype, email, phone)		3	2				5				2	
Discount cards				2			2				1	
Smoking support					1		1				1	
Records of people				1			1				1	
Complaints/compliments box		1					1				1	
Walking groups							0				0	

\*Relative importance = [(score for the item) ÷ (maximum points for the group i.e. participant number x 15 points) x 100]

McMillan SS, Kelly F, Sav A, Kendall E, King MA, Whitty JA, Wheeler AJ. The paper we needed at the beginning: how to analyse results from the nominal group technique. The final definitive version of this paper has been published in *Health Services and Outcomes Research Methodology* DOI:10.1007/s10742-014-0101-1. **Table 2: Secondary analysis of pilot group data**

Secondary coding: top five themes only (option A)	Secondary coding: all themes in the group (option B)
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Overarching theme ( <i>raw idea</i> )	Sum of scores (raw)	Freq. of voting (raw)	Summing by votes <sup>+</sup> (priority score for top 5)	Ranked priority	Ranked priority (scores & freq.)	Sum of scores (for all themes)	Ranked priority (via scores for themes)	(%)*	Ranked priority (via %)	Freq. of voting (for all themes)	Ranked priority (scores & freq.)
<b>Continuity &amp; coordination of care</b> ( <i>Care coordination</i> )	24	5	5	#1	#1	30	#1	33.3	#1	8	#1
<b>Quality of service delivery</b> ( <i>Professional competence</i> )	15	4	4	#2	#3	16	#3	17.8	#3	5	#3
<b>Consumer information or education</b> ( <i>Health information</i> )	14	5	3	#4	#4	14	#4	15.6	#4	5	#4
<b>Access</b> ( <i>24-hour access</i> )	14	4	3	#2	#2	21	#2	23.3	#2	8	#2
<b>Access</b> ( <i>Environment</i> )	7	4	1	#		-	-	-	-		
<b>Affordable</b> ( <i>Consistent medication pricing</i> )	6	2				8	#5	8.9	#5	3	#5
<b>Continuity &amp; coordination of care</b> ( <i>Follow up</i> )	5	2				-		-			
<b>Affordable</b> ( <i>Discount cards</i> )	2	1				-		-			
<b>Health promotion</b> ( <i>Smoking support</i> )	1	1				1				1	
<b>Continuity &amp; coordination of care</b> ( <i>Records of people</i> )	1	1				-		-			
<b>Quality of service delivery</b> ( <i>Complaints/compliments box</i> )	1	1				-		-			
<b>Health promotion</b> ( <i>Walking groups</i> )	0	0				0		0			

+Summing by votes: Points allocated to each theme as per priority list via raw scores (i.e. top priority = 5 points, fifth priority = 1 point). # There is no fifth priority as access arose as a theme twice in the top 5 (i.e. joint third priority points + fifth priority points = 4).



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\*Relative importance = [(total score for the theme) ÷ (maximum points for the group i.e. participant number x 15 points) x 100]

**Supplementary Table 1: Description of conceptual papers and studies utilizing the nominal group technique.**

Author (Yr.)	Description of conceptual paper	Additional NGT information	Recommended or actual ranking process
Allen <i>et al</i> (2004)	Description of NGT stages; adapted NGT; case example.	Suggested: 9-12 participants. Qualitative survey sent to a target group in a different region; responses categorized into themes to generate Likert questionnaire statements; postal questionnaire to NGT participants; analysis and revised questionnaire to remove consensus statements; NGT participants given a second, individualized questionnaire with their original scores and median group scores; group discussion and individualized re-scoring; post-group analysis to determine degree of consensus.	2 rounds: Individual ranking of initial questionnaire; individual re-scoring of second questionnaire.
Bartunek & Murnighan (1984)	Description of NGT stages; adapted NGT process.	Introduction to process; presentation of problem; silent generation; round robin; discussion (clarification – categorization, discussion, new ideas and discussion); reflection; straw vote and discussion; public vote (to increase acceptance). Clarification process: groups wrote suggested ideas down, passed it to other groups who wrote additional questions or comments, groups revised list via clarification.	2 rounds: Anonymous rating with four categories (e.g. absolutely no, absolutely yes). Ratings/ comments summarized and fed back; group discussion and public voting of ratings.
Carney <i>et al</i> (1996)	Rationale for using NGT; description of stages; case example.	3 separate groups (5-8 per group).	1 round: Chose and ranked five ideas (1=most important; 5=least important)
Claxton <i>et al</i> (1980)	Description of NGT stages; case example, comparison with surveys and focus groups.	Round robin phase: participants can briefly explain their point to ensure clear meaning. Clarification phase: ensure participants understand responses and eliminate duplicate ideas.	1 or 2 rounds: participants ranked top eight problems. Second round is recommended if a reasonable level of consensus is required or there is high variability.

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Gallagher <i>et al</i> (1993)	Description of NGT stages; Comparison with focus and brainstorming groups; case example.	Separate consumer and health professional (mixed professionals) groups.	2 rounds: Individuals ranked top 10 items; group discussion; individuals re-rank and allocate value towards each ten items (0-100; 100 being most important item).
Jones & Hunter (1995)	Defines consensus and consensus methods; describes NGT and Delphi techniques and associated methodological issues.	Suggested: 9-12 participants. Stated that consensus does not mean that the correct answer has been found, the NGT is a method for identifying common opinion and areas of disagreement.	2 rounds: Individuals rank each idea; group discussion; individuals re-rank.
Potter <i>et al</i> (2004)	Compares NGT, focus and brainstorming groups; issues to consider; description of NGT stages including analysis; review of NGT research and application in health.	Suggested: 5-9 participants.	2 rounds: Individuals chose top ten items (1=least important; 10=most important); value allocated (0-100; 100 being most important item)
Sink <i>et al</i> (1983)	Description of NGT stages; case examples.	Discussion of group consensus after individual voting and ranking. If there are difficulties in clarification, allow individuals to note down what they perceive as overlapping ideas and vote for the idea/point they feel is most representative.	1 round: Rank ideas (1=least important; highest number=most important). Number to rank depends on number of ideas: 15 ideas = 5 votes; 20-30 = 7 votes; >30 = 9 votes.

Author (Yr.)	Question/s or task of study	Additional NGT information and recommendations	Ranking/ Consensus process
Bissell <i>et al</i> (2000)	How would you assess whether a consultation between pharmacy staff and a consumer was in/appropriate?	1 group: experts from practice, academic or policy areas of community pharmacy ( $n=8$ ). Information pack included: study purpose, transcripts of advice-giving from community pharmacies (previous stage) and readings on appropriateness measurements. Discussion: inclusion or exclusion of an item decided via majority of hands. Participants sent criteria for further consideration and to comment on suitability one week after focus group.	1 round: Individuals asked to prioritize, however felt this was impossible given the degree of inter-dependence between categories. A unanimous group decision led to assigning similar weight to each criterion.

Dening <i>et al</i> (2012)	To consider what their preferences for care would be if they were approaching death.	3 groups: people with dementia ( $n=5$ ), carers of people with dementia ( $n=6$ ), people with dementia and their carers ( $n=3$ dyads). Round robin phase involved two separate parts: Discussion (including clarification) and further generation of ideas.	1 round: Individuals ranked top five items (1=most important; 5=least important).
Dewar <i>et al</i> (2003)	What problems do you experience when dealing with your chronic pain? What would you like to see happen to better meet your needs as a person in pain?	Advertised as a needs assessment public forum with educational workshop on pain management strategies to encourage participation. 10 groups ( $n=3-7$ per group). <i>NGT can be used to develop questions for more in-depth surveys.</i>	1 round: Individuals ranked top five items.
Gastelurrutia <i>et al</i> (2009)	To identify facilitators for practice change in Spanish Community Pharmacies.	Part of the study involved 2 NGTs: community pharmacists ( $n=7$ ) and strategists ( $n=7$ ). Scores presented to participants to verify results were a true reflection of their views.	1 round: ranking of the facilitators in terms of importance (1=low, 5=high) and applicability (1=low, 10=high).
Hiligsmann <i>et al</i> (2013)	To determine the most important attributes for osteoporosis drug therapy	5 groups of people with osteoporosis or had a recent fracture requiring osteoporosis medication ( $n=26$ ; 4-8 per group). 12 attributes randomly divided into five sets and each of the groups received a different ordering of these sets. No silent generation phase as attributes were identified in the literature, however participants could include any missing attribute in first ranking. NGT sessions conducted until rank order of the most important attributes did not change any further. <i>Clear description and explanation of any attribute is required. Avoid ranking too many attributes as this could place substantial cognitive burden on participants (e.g. rank their 5 most important attributes).</i>	2 rounds: Individuals rank attributes (1=most important, 12=least important). Group review of scoring and individual opportunity to re-rank.
Hutchings <i>et al</i> (2012)	What are the positive and negative exemplars of patient-centred professionalism within community	2 NGTs: workshop ( $n=34$ ) and a mixed-group forum event ( $n=17$ ). Participants: members of the public, stakeholders, community nurses (separate groups).	1 round (initial NGT): Individual ranking of exemplars (1=most important, subsequent ranks of diminishing importance).

	nursing?	Forum participants asked to rank the themes (that they viewed as important) from the first workshop prior to attending the forum. Forum discussion then individual re-ranking to develop a final consensus ranked list. <i>Approach can be applied to a mixed group of individuals (e.g. forum)</i>	2 rounds (mixed-group forum): Individual ranking of themes in order of importance (1=most important) prior to the forum. Re-ranking of themes at forum.
Miller <i>et al</i> (2000)	What issues or concerns have you had to deal with since diagnosis? What issues or concerns have you had to deal with since you learned your family member had diabetes?	2 groups: People with diabetes ( $n=13$ ) and caregivers ( $n=8$ ). The two groups were described as being in the same NGT meeting. <i>At least two groups of 6-12 people should be involved. Conduct separate groups based on gender, race and age.</i>	1 round: Individuals ranked top five items (1=least important; 5=most important).
Potter <i>et al</i> (2003)	The qualities of a 'good' physiotherapist, and the physiotherapy experience.	Piloted with 5 patient volunteers. 6 groups with 3-5 current and former physiotherapy patients ( $n=26$ ).	1 round: voting and ranking of ideas.
Sanderson <i>et al</i> (2012)	What results would you want from a drug treatment when your rheumatoid arthritis is bad?	5 groups ( $n=26$ patients with rheumatoid arthritis). Single and mixed gender groups. Groups prioritised and rated outcomes from a previous study. Participants asked to firstly rate the importance of 63 outcomes (not important, important and very important). Re-rated the very important outcomes (very important and most important). The most important outcomes were discussed in a round robin followed by the last rating and ranking.	3 rounds: individually rated the importance of the outcomes twice to identify the most important ones. Individuals then ranked top five outcomes. Survey then conducted.
Tully & Cantrill (2002)	How can we [as pharmacists] assess inappropriate drug therapy of individual patients that is responsive to pharmaceutical care?	1 group: hospital pharmacists ( $n=2$ ), community pharmacists ( $n=4$ ), academics/researchers ( $n=3$ ) and pharmacologist ( $n=1$ ). Provided participants six key articles about appropriate prescribing to ensure a similar conceptual basis. Discussion with participants of the issues surrounding pharmaceutical care to develop research question.	1 round: individuals had to consider the importance and operationalisability of the items. Consensus at >70% agreement.

Vella <i>et al</i> (2000)	Many questions relating to various topics e.g. should relatives be present at resuscitation attempts? Does the presence of an advanced nurse practitioner affect outcomes etc.	1 group: 10 doctors, 2 nurses from different geographic locations and roles ( $n=12$ ). First-round questionnaire: rate level of support for 100 topics. Likert scale (1=no support, 5=moderate support, 9=strong support). Second round questionnaire (NGT) – personalized with own ratings and distribution of ratings from 1st questionnaire. Opportunity to reconsider initial ratings. Questionnaire sent to other professionals not previously involved to assess representativeness of NGT's views.	No pressure to achieve consensus.
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**Supplementary Table 2: Types of analysis for NGT**

Methodology	Description of the method	Further description of analysis	Examples	Presentation of results
	<i>Summing by votes</i> (sum of votes per item)	Identification of consensus (any score >70%).  Collation of group scores to identify overall priority.  Calculated the percentage of maximum possible score.  Proportions/aggregated score (score x100/maximum possible score).	Tully and Cantrill (2002)  Denning <i>et al</i> (2012)  Sanderson <i>et al</i> (2011)  Gastelurrutia <i>et al</i> (2009)	<ul style="list-style-type: none"> <li>Described number of ideas (before and after clarification) and themes.</li> <li>Table: themes, items, sum of votes and if consensus was reached.</li> <li>Bar graphs: sum of votes for each item for each group and overall (in rank order).</li> <li>Described number of items (before and after ranking), and top five items prioritised overall (%).</li> <li>Tables: aggregated scores for each item from each group (ranked by importance and then by applicability).</li> <li>Priority matrices: compare importance and applicability per group.</li> </ul>
	<i>Summing by votes and impact of NGT on ranking</i>	Impact of NGT on ranking (at individual and group level).	Hiligsmann <i>et al</i> (2013)	<ul style="list-style-type: none"> <li>Bar graph: number of groups where the attribute was ranked in the top five.</li> <li>Table: initial, final and average rankings per each attribute for all groups.</li> <li>Described the number of participants who changed ranking after NGT, and the average absolute change between rankings (also shown as a bar graph).</li> </ul>
	<i>Summing by votes</i> (ranking by score and/or frequency)	Frequency of actual scores per item shown (e.g. documented each participant vote).  Researchers developed a standardised classification system, group responses were re-classified.	Miller <i>et al</i> (2000)  Dewar <i>et al</i> (2003)	<ul style="list-style-type: none"> <li>Described number of themes generated per group.</li> <li>Tables: votes accorded per item (i.e. ratings by participants) and corresponding sum of votes per group. Organised in order of priority (by sum).</li> <li>Tables: Overall, top priorities and solutions for groups (by frequency).</li> </ul>

	<i>Summing by votes, median and range</i>	Calculated number of times an item was ranked first to fifth (i.e. in top five priorities).	Aspinal <i>et al</i> (2006)	<ul style="list-style-type: none"> <li>• Tables: top themes for each group with associated score, median, range and theme; themes given the top ranking by participants (demonstrated by frequency of vote).</li> </ul>
	<i>Median and Interquartile ranges (IQR)</i>	Consensus ranked list based on the final median ranks.	Hutchings <i>et al</i> (2012)	<ul style="list-style-type: none"> <li>• Tables: Lists the ideas generated from each group; list of final themes, median ranked thematic lists prior and after a forum event (including IQR).</li> </ul>
	<i>Mean and standard deviation (SD)</i>	Also showed frequency of vote.	Kristofco <i>et al</i> (2005)	<ul style="list-style-type: none"> <li>• Described the number of individual items, the items endorsed as the most important.</li> <li>• Table: mean, SD, and frequency of votes for each rating.</li> </ul>
<b>Qualitative</b>	<i>Descriptive</i>	Listed ideas (not themes) generated by groups.	Miller <i>et al</i> (2000)	<ul style="list-style-type: none"> <li>• Table: listed the remaining ideas that were not prioritised.</li> <li>• No quotes provided.</li> </ul>
		Further information on priorities.	Dewar <i>et al</i> (2003)	<ul style="list-style-type: none"> <li>• Quotes: used to exemplify priorities.</li> </ul>
		Listed and described themes.	Bissell <i>et al</i> (2000)	<ul style="list-style-type: none"> <li>• Described number of individual items; number of criteria (themes) initially produced then reduced following discussion.</li> <li>• Table: description of each criterion (theme) after validity.</li> <li>• Described emergent themes using quotes and listed the priorities for each group.</li> </ul>
	<i>Content or thematic analysis</i>	Content analysis to support and confirm content validity.	Dening <i>et al</i> (2012)	<ul style="list-style-type: none"> <li>• Described emergent themes using quotes and listed the priorities for each group.</li> </ul>
		Grounded Theory coding paradigm.	Sanderson <i>et al</i> (2011)	<ul style="list-style-type: none"> <li>• Themes and quotes used to provide insight into prioritization.</li> </ul>
		Themes with examples.	Aspinal <i>et al</i> 2006	<ul style="list-style-type: none"> <li>• Table: list of themes, description of theme and representative quotes.</li> </ul>
		Researchers developed a final set of common themes.	Hutchings <i>et al</i> (2012)	<ul style="list-style-type: none"> <li>• Table: list of final themes and examples.</li> </ul>

<i>Analyst triangulation</i>	Conducted by two independent researchers.	Potter <i>et al</i> (2003)	• Tables: lists ideas provided by 3 or more groups; ideas provided by 1-2 groups (organized according to themes); quotes representing ideas
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