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Differential Qualitative Analysis: A Pragmatic Qualitative Methodology to Support Personalised Healthcare Research in Heterogenous Samples

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Differential qualitative analysis (DQA) was developed as a pragmatic qualitative health methodology for the exploration of individual differences, behaviours, and needs within heterogeneous samples. Existing qualitative methodologies tend to emphasise the identification of general principles, an approach that can lead to standardised treatment, care, and medicine. DQA emphasises the identification of individual variation, in order to inform personalised healthcare. DQA comprises an accessible three-stage approach: first individual profiles are explored and differentiated into research-relevant subgroups; then each subgroup is analysed, and findings identified; finally, the data is analysed in its entirety and overall and subgroup findings are presented. DQA was developed as a new qualitative approach to: (1) emphasise the identification of person and patient-centered findings; (2) facilitate the analysis of sample heterogeneity, including variation in responses and intervention outcomes; (3) provide a convenient, pragmatic, systematic, and transparent methodology; (4) bridge the qualitative-quantitative divide with a mutually accessible approach. DQA may be particularly relevant for mixed methods research, early-stage interventions, and research exploring personalised and patient-centred care, and integrative medicine. Keywords: Person-Centered Research, Patient-Centered Research, Personalised Healthcare, Mixed Methods, Subgroup Analysis

Introduction

Differential qualitative analysis (DQA) was developed following challenges encountered in a mixed methods feasibility study of a novel laughter and well-being prescription (Gonot-Schoupinsky & Garip, 2019). The prescription was tested for one week in a sample of healthy adults aged 25 to 93. Substantial heterogeneity in participant reactions, effects, and behaviours was reported. Sensitivity to patient-centered concerns is embedded in the philosophy of integrative medicine (Maizes, Rakel, & Niemiec, 2009), and therefore this variation was explored to identify how the prescription could be optimised for personal needs and preferences. Thematic analysis (Braun & Clarke, 2006) was used to analyse 21 in-depth interviews, however its constant comparative approach to analyse across the entire data body was found to be cumbersome for exploring heterogeneity. Data management was also challenging. The extraction and retention of individual detail was facilitated using coding techniques inspired by Saldaña (2009). Later these would establish the foundations of DQA coding.

Following the intervention, DQA was researched and developed as a discrete methodology to avoid method slurring (e.g., Khankeh, Ranjbar, Khorasani-Zavareh, Zargham-Boroujeni, & Johansson, 2015), and to respond to needs experienced during the research, and issues raised within the healthcare literature. DQA was formulated as a pragmatic, convenient,

and accessible qualitative approach to explore data heterogeneity and benefit personalised healthcare research. Although it builds on the foundations of qualitative research, DQA was inspired by subgroup analysis, an approach which classifies or stratifies data into research-relevant subgroups for exploratory purposes. Subgroup analysis can be a fundamental step within quantitative health data analysis, for instance to analyse treatment effectiveness according to patient characteristics (e.g., Tanniou, van der Tweel, Teerenstra, & Roes, 2016).

The use of subgroup analysis in qualitative research is atypical, despite Glaser and Strauss (1967) suggesting "the active creation of diverse comparison subgroups" (p. 211) as a useful approach to generate theory. Onwuegbuzie and Leech (2007) also recommend subgroup comparisons in their sampling design typology to ameliorate the qualitative research challenges of "representation, legitimation and praxis" raised by Denzin and Lincoln (2005). DQA uses subgroup analysis as a way to classify or stratify, explore, code, categorize, and analyse data samples to inform research aims.

Interest in personalised healthcare means that the needs of qualitative research are evolving, and DQA was formulated to: (1) place an equal emphasis on both person-centered and general findings; (2) facilitate analysis of variation in samples, including response or intervention outcome heterogeneity; (3) provide a convenient, pragmatic, systematic, and transparent methodology; and (4) bridge the qualitative-quantitative divide with a mutually accessible approach.

Evolving Research Needs

Qualitative research is evolving to include methodology traditionally associated with quantitative research, such as the use of randomized samples and the exploration of intervention and treatment outcomes, resulting in pragmatic improvisation alongside traditional uses of qualitative methodologies (Chenail, 2011b). The benefits of personalised healthcare and the limitations of standardized health treatment, for instance standardizing treatment can result in both under-treatment and over-treatment (e.g., Imperial et al., 2018), are modifying research needs.

Quantitative analysts are calling for "substantial efforts in person-centered science" to reflect both interindividual and intraindividual differences (Fisher, Medaglia, & Jeronimus, 2018). New methodologies relevant to personalised healthcare are needed to counteract "the current one size fits all approach to preventative and clinical healthcare" (Ricciardi & Boccia, 2017). The need for a convenient qualitative approach consistent with the goals of patient-centred research, i.e., to be "respectful of and responsive to individual patient preferences, needs, and values" (Greene, Tuzzio, & Cherkin, 2012, p. 49), also seems apparent.

A wider perspective towards sample homogeneity and heterogeneity may support changing research needs. Braun and Clarke (2013) state in their guide Thematic Analysis: "different *types* of people are not sampled in qualitative research so that you can generalise to all other people of that *type*" (p. 56). This approach leads to studies exploring outwardly identifiable homogeneous samples, e.g., people of similar ages, socio-economic backgrounds, or medical issues, as opposed to the systematic exploration of person-centered heterogeneity within these samples. Person-centered research aims to: "respect the uniqueness of individuals by focusing on their beliefs, values, desires and wishes, independent of age, gender, social status, economy, faith, ethnicity and cultural background..." (McCormack, van Dulmen, Eide, Skovdahl, Eide, 2017, p. 4).

DQA is inspired by the quantitative *a priori* assumption of data heterogeneity towards person-centered research, i.e., that the data to be explored is assumed to be heterogeneous (Little, 2013). DQA emphasises the analysis of "different types of people." Subgroup analysis enables outwardly homogenous samples, samples that include heterogeneity (e.g., maximum

variation sampling), and samples that report outcome heterogeneity, to be explored for additional insight.

Personalised healthcare research ideally entails timely data assessment, and data which can be easily shared (e.g., Ricciardi & Boccia, 2017). Chenail (2011b) stresses the importance of simplicity in research methodology to ensure resources are focused on the complexity of the research itself. Consequently, DQA is designed to be convenient to use. It also responds to calls for greater transparency in qualitative research (Tuval-Mashiach, 2017) by enabling data to be systematically reduced, coded, and categorized to simplify documentation, editing and sharing. DQA is intended to be accessible to both qualitative and quantitative researchers to maximise the use of their complementary benefits (Denzin & Lincoln, 2005). Despite calls to multiply the genres and styles of qualitative research (Dey & Nenwich, 2006), the epistemological divide between qualitative and quantitative analysis remains challenging (Yardley & Bishop, 2015). Morse et al. (2011) view language as a barrier to collaboration; therefore, DQA terminology is intended to bridge the divide.

What Makes DQA Different

Dey and Nenwich (2006) envisaged a need to transform the rules of qualitative research when calling for new qualitative approaches. DQA maintains these rules, but transforms how they are used, so they become more relevant to personalised healthcare. Two traditional qualitative "rules" are re-located to later stages of the data analysis in DQA. Firstly, a preference for, or assumption of, sample homogeneity is not necessarily made, as samples are all considered to be heterogeneous, and are therefore explored to investigate research-relevant subgroups. Secondly the emphasis on extracting general principles from analysis using the constant comparative method is only undertaken at the last stage of the analysis.

Existing qualitative approaches vary according to epistemology (the philosophical stance taken), the settings and methods used, and the level of detail involved in extracting and presenting the data. Nevertheless, data reduction and condensation processes are similar. They were derived from a methodology developed to compare the experiences of dying patients (Glaser & Strauss, 1965). Extraction of a general theory from these experiences led to the formulation of grounded theory; it involves the constant comparison of data across the entire sample to code across the entire data (Glaser & Strauss, 1967). Six qualitative approaches used in health research share this similar objective, i.e., to view the data as a whole, and code across it, in order, primarily, to uncover commonalities:

1. Grounded theory: "Generalizations... help us broaden the theory so that it is more generally applicable and has greater explanatory and predictive power" (Glaser & Strauss, 1967, p. 24).
2. Ethnography: "The aim is to 'get inside' the way each group of people sees the world" (Reeves, Kuper, & Hodges, 2008, p. 512).
3. Thematic analysis: "Thematic analysis involves the searching across a data set... to find repeated patterns of meaning" (Braun & Clarke, 2006, p. 86).
4. Discourse analysis: "People do not make meaning just as individuals... Many forms of discourse analysis are thus connected to views about and studies of different types of social groups" (Handford & Gee, 2012, p. 5).
5. Interpretative phenomenological analysis (IPA): IPA is concerned with "moving from the particular to the shared" (Smith, Larkin, & Flowers, 2009, p. 79).

6. Content analysis: "the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005, p. 1278).

Of course, all these approaches also enable and encourage the exploration of individual differences. Interpretative phenomenological analysis (IPA; Smith et al., 2009) has a strong "idiographic commitment" or concern with the particular, and "IPA researchers usually try to find a fairly homogeneous sample for whom the research question will be meaningful" (p. 49). There are two potential issues with this: firstly, the assumption that samples are homogeneous prior to any analysis being undertaken may not be in the interests of person-centered research. Secondly constant comparisons across the entire data body to identify commonalities so that theory or themes can be identified further risk individual nuances being overlooked. Glaser and Strauss (1967) even state in their seminal book (p. 30) "accurate evidence is not so crucial for generating theory." This approach is more aligned to the identification of standardized approaches to healthcare, as it dilutes the potential for individual data to be accurately retained. For person-centered healthcare research, where the *a priori* assumption is one of data heterogeneity, subgroup analysis is a useful way to explore differences. To accommodate this additional step, DQA changes the order in which traditional qualitative research rules are applied. Firstly, samples are assumed to be heterogeneous, in order to then break them down and explore potentially research-relevant homogenous groupings; and secondly, the constant comparative approach is only applied once this heterogeneity has been explored.

Strengths of DQA

Patient-centered qualitative research can be critical to improving primary healthcare and adapting approaches to undertake this research is of interest (Chenail, 2011b). DQA is conceived to be accessible for all researchers to emphasise findings that enable accurate insight into personalised healthcare needs. DQA places an equal emphasis on the identification of individual differences as it does on the identification of general principles in order to gain insight into personalised healthcare variation. While general principles are of interest in all samples analysed, people react differently both interindividually and intraindividually and have individual needs and values; more research taking these differences into account is needed (e.g., Di Paolo, Sarkozy, Ryll, & Siebert, 2017; Fisher et al., 2018).

Qualitative health research should place people at its center (Morse, 2012). Qualitative research is a fundamentally scientific process (e.g., Sale & Thielke, 2018) and DQA encourages the identification of 'accurate evidence'. DQA methodology enables the formulation of general theory but emphasises the exploration, identification, analysis, and synthesis of research-relevant differentiation. DQA may be of particular relevance to mixed methods research as this enables individual quantitative and qualitative data to be compared. When health interventions result in varied reactions, behaviours, and levels of efficacy "why" and "why not" questions (e.g., McLean, 2006) can be explored using subgroup analysis. Subgroups may relate to any research-relevant phenomenon, including personality, attitudes, circumstances, desires, and behaviour disclosed by participants, or observed and interpreted by the researcher. This analysis may inform ways for improving health interventions, including tailoring them at an individual level.

Conducting a DQA

A DQA consists of the three-stage exploration of individual, differentiated, and overall data; this and the nine steps it involves are presented in Figure 1. The example text comes from stand-alone qualitative research exploring perceptions of aging. In DQA firstly individual data is explored and classified within subgroups that can inform research aims; secondly subgroups are analysed to identify findings specific to each; and thirdly the entire data body is analysed to identify overall findings. Each stage is discussed in more detail.

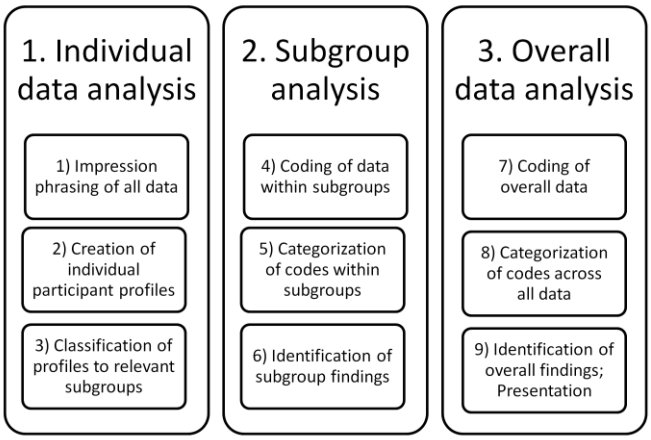

Figure 1. Three stages to performing a Differential Qualitative Analysis

1. Individual data analysis

This stage involves three steps. Individual participant data is explored inductively using impression phrases, a technique proposed by Saldaña (2009), to "decode" or interpret data. Participant profiles are then created, and classified into research-relevant subgroups.

1) Impression phrasing of data

After familiarisation with the data, including listening to recordings where possible, the text is explored line-by-line to divide all the text into segments. The main objective is to identify segments of text, either words, a line(s), a sentence(s), or paragraph(s) that are meaningful (e.g., Chenail, 2012) and appear to communicate something of importance relating to research objectives. An impression phrase is extracted from each text segment as shown in Figure 2. Impression phrases are either *in vivo* (the actual words of the participant or individual), and, or, researcher impressions, thoughts or opinions, as shown in the example in Table 1. All the impression phrases are extracted into a codebook (Table 1) enabling them to be easily retrieved and edited.

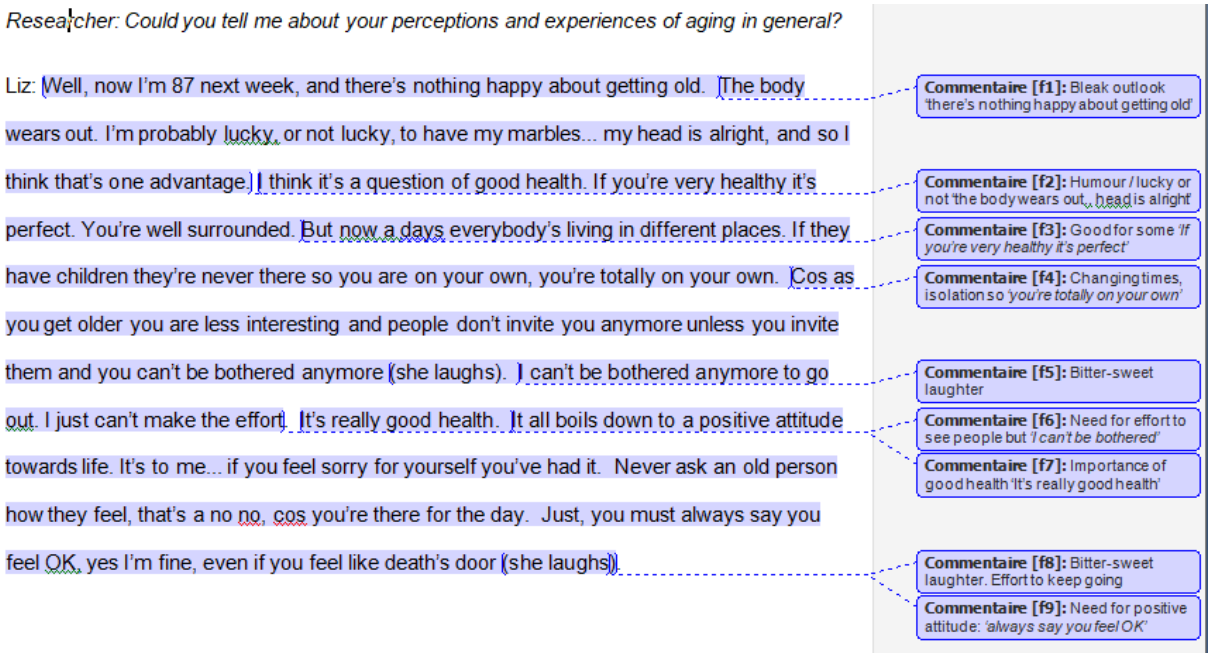

Figure 2. Highlighting text segments to extract impression phrases

Table 1. Sheet from a codebook with impression phrases and codes

Text Segments	**Impression phrases extracted**		**Initial Coding**	**Final Code**
	In vivo	Researcher impressions	Two/three-part	One word
1	"there's nothing happy about getting old"	Bleak outlook	Emotion-sadness	Sadness
2	"the body wears out... my head is alright"	Humour / lucky or not	Humour-realism	Humour
3	"If you're very healthy it's perfect"	Good for some	Health-importance	Health
4	"you're totally on your own"	Changing times, isolation	Isolation-culture	Isolation
5	Participant laughs	Bitter-sweet laughter	Emotion-resignation	Acceptance
6	"I can't be bothered"	Need for effort to see people	Motivation-socialising-low	Socialising
7	"It's really good health"	Importance of good health	Health-importance	Health
8	"always say you feel OK"	Need for positive attitude	Attitude-brave-effort	Positivity
9	Participant laughs	Bitter-sweet laughter; effort to keep going	Challenge-effort	Effort

Note. As the analysis progresses additional columns can be added

2) Creation of short individual research-relevant data profiles

Impression phrasing enables the researcher to become familiar with each participant profile. Individual profiles are created in the form of a paragraph or short list, highlighting research-relevant characteristics of the individual. The original text should be referred to during this process; this also enables the impression phrasing to be refined if necessary.

3) Classification of profiles to research-relevant subgroups

Individual profiles are classified into differential subgroups in a way that is most likely to inform research objectives. This process is facilitated by the individual profiles but should consider all the data disclosed by participants, revealed *in vivo*, or as interpreted by the researcher. It may also entail the use of theory (e.g., personality differences), and in the case of mixed methods research, quantitative data. For example, participants may be grouped according to intervention results i.e. to what extent an intervention was effective or not. Other groups may be according to whether participants found instructions easy to follow or not; or whether an intervention was enjoyable for them or not.

The aim is to classify individual data samples into manageable research-relevant subgroups. Two to four subgroups, or more in larger samples, may be adequate. A subgroup may consist of one person if the sample is small, or if there is a clear outlier to highlight, but normally it would be at least two. There are likely to be a number of relevant ways to classify subgroups, but the most relevant to immediate research objectives should be chosen. Additional subgroup analysis can always be undertaken to strengthen and expand findings.

2. Subgroup analysis

Subgroups are explored and coded; codes are categorized; and findings are identified. These three steps are discussed in greater detail:

4) Coding of data within subgroups

DQA coding is tapered to facilitate data condensation and transparency. Coding is inductive and a two or three-part code is initially identified for each impression phrase; this technique, inspired by Saldaña (2009) can be helpful to retain detail and facilitate a final code, and later categorization. A final one-word code can then be designated (See Table 1). If other coding techniques are preferred, they can be used, but should be identified and explained. Codes are streamlined within subgroups, but there is no need to do this between subgroups unless it is helpful; certain codes may be the same across subgroups. DQA coding is intended to be transparent, so that it is easy to relate the coding process to the original data (see Table 1). This can also facilitate editing purposes as initial coding should be reviewed several times. While impression phrasing facilitates encoding, or the identification of codes, coding should also involve recourse to the original text.

5) Categorisation of codes within each subgroup

Categorisation may be inductive or deductive depending on research objectives, the subgroup classification, and the potential planning and evaluation frameworks used. The purpose of categorisation is to systematically organise the codes in a way that can facilitate the interpretation of research aims. The methodology used to do this should be explained.

6) Identification of findings within each subgroup

Research-relevant findings are identified within each subgroup. The number of findings for each subgroup and the scope of these findings will likely vary; there should be no attempt to standardise them.

3. Overall data analysis

The objective now is to extract key findings from the entire data body; this is analogous to the approach of current qualitative methods. The overall data is coded and categorized, using the existing work to guide this. Overall findings are then identified, and presented together with subgroup findings. The three steps relating to this stage are discussed in more detail:

7) Coding across all the data

This process should involve recourse to the original data, impression phrasing, and subgroup coding. Final subgroup codes provide a convenient start-point for overall coding; otherwise it can begin again using the impression phrasing. If final subgroup codes are used, they must be re-evaluated so as to appropriately standardize them across the data. This may involve renaming and recreating codes as appropriate. Other approaches can be used but should be explained.

8) Categorization of codes across all data

Depending on whether categorisation is inductive or deductive the same categories as used in the subgroup analysis may be used. The methodology should be explained.

The data are explored within the relevant categories, and in reference to the original text, impression phrases and codes. The main aims are to identify similarities and patterns across the participants and data that are relevant to research objectives.

9) Identification of overall findings and presentation

One of the aims of a DQA is to bridge the epistemological divide by presenting and discussing qualitative research using language that is mutually accessible. Data are therefore analysed to extract "findings" that are research relevant and formulated in ways that can facilitate future qualitative and/or quantitative research. Findings should be coherent to research objectives, the phenomenon analysed, and the implications reported (Chenail, Duffy, St. George, & Wulff, 2009). They can be summarised as short phrases and sub-phrases, or bullet points and sub-points, and expanded on as needed. Labelling findings can facilitate on-going research, e.g., whether they relate to new hypotheses, proposed theory, ideas and concepts, or exploratory themes etc. Presenting findings so they are accessible to potential end users, for instance healthcare providers (Chenail, 2011a), is also important.

Concluding Thoughts

DQA responds to a need for innovative methodologies to support research into personalised healthcare. DQA proposes a pragmatic, accessible, systematic and transparent approach to qualitative data exploration, analysis and synthesis that emphasises insight into

research-relevant differentiation in heterogeneous samples. Developed for use in mixed methods health interventions, DQA may be suitable for stand-alone qualitative research where objectives include understanding and exploring individual variation, including in research pertaining to personalised and patient-centered care and integrative medicine.

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