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The Use of Qualitative Data Analysis Software (QDAS) to Manage and Support the Analysis of Think Aloud (TA) Data

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Abstract

This methodological paper describes how qualitative data analysis software (QDAS) is being used to manage and support a three-step protocol analysis (PA) of think aloud (TA) data in a study examining emergency nurses' reasoning during triage. The authors believe that QDAS program QRS NVivo© will greatly facilitate the PA and will allow them to identify and describe the information that triage nurses concentrate on during triage, and how they structure this information to make a triage decision. These findings could assist in designing and creating decision support systems to guide nurses' triaging. Additionally, details about how to use QRS NVivo© for PA of TA data may assist and guide future informatics research using similar methodology are presented here. This innovative use of QDAS holds great promise for future nursing informatics research.

Keywords: *Qualitative Data Analysis Software, Think Aloud, Method, Protocol Analysis, Emergency Care, Triage*

Introduction

Decision support system development in nursing practice relies heavily on research examining how nurses structure information, form meaning about relevant information and search for missing information during a problem-solving task. This is commonly discovered through think aloud (TA) method, whereby participants verbalize their thoughts while reasoning about a simulated or real-life problem-solving task.

It is believed to be possible to capture components of individuals' reasoning processes through TA, which is why this method is frequently used in research for decision support system development. In order to capture the reasoning strategies that individuals utilize used during the problem-solving task, it is important that the cognitive task is appropriate for and representative of the area of domain expertise of the population represented by the participants, who are instructed to verbalize their thoughts while problem-solving. Their verbal protocols are captured on audiotape, transcribed and then analyzed using protocol analysis (PA), a structured and pragmatic form of qualitative analysis.

The three-step approach to PA that was employed in the study reported in this paper was originally described by Kuipers and colleagues in their research examining physicians' reasoning, [1, 2] and was later further described by Fonteyn and colleagues in studies examining nurses' clinical reasoning. [3, 4] Despite the growing prevalence of TA method in nursing research, studies using the structured approach to PA described by Kuipers, Fonteyn and co-workers have been limited. And, although a few studies have been published describing the use of TA method to examine emergency nurses triaging, [5, 6] this is still an area where little is known about how nurses problem solve and make decisions to determine a patient's acuity rating.

Triage, when performed in the emergency department (ED), has been shown to be a complex problem-solving task that requires specialized knowledge and experience. [7] Although this task is commonly performed by nurses, there is still insufficient knowledge about how ED nurses reason to make a triage decision, what information they concentrate on, what information they seek that is unavailable during the immediate triaging task, and how they structure their thoughts during triaging.

Although, Fonteyn previously used the QDAS Nudist© to manage and support her analysis of TA data in a study examining the thinking strategies that expert nurses utilize to resolve clinical dilemmas, she did not provide specific details about this methodological strategy in the published monograph of her study. [8] The current paper will give more detail about the use of QDAS, and more specifically, how QRS NVivo© can facilitate PA, building on the previous work by Fonteyn, Kuipers and their colleagues. [1,2] The three-step PA process includes: Referring Phrase Analysis (RPA) Assertional Analysis (AA), and Script Analysis (SA). This three-step process will provide a fuller description

of how ED nurses reason during the problem-solving task of triage.

Description of the Study

The study that was the impetus for the methodology described in this paper was designed to provide a description of how ED nurses reason to make a triage decision, what information they concentrate on, what information they seek that is unavailable during the immediate triaging task, and how they structure their thoughts during triaging.

This will increase current knowledge about this difficult cognitive task, will provide essential information for building decision support systems and other tools to facilitate nurses' triaging, and will guide future research examining nurses' triaging.

The participants in this study were a subset of a larger sample from the ongoing study examining ED nurses ability to triage. This subset consisted of two categories of ED nurses: those who demonstrated advanced ability to triage (n=8) and those who exhibited limited ability to triage (n=8), based on their triage acuity ratings using a triage scale. The average age of participants was 38.5 years, with an average of 6.2 years of emergency nursing experience. Both genders were represented, as well as a variety of types and geographical location of emergency settings in Sweden.

Having each participant think aloud while reasoning to make triage decisions for five distinct simulated patient cases carried out our data collection. The cases were adapted from actual situations of patients from emergency settings in Sweden, and had been validated for realism and relevance by a panel of three Swedish nurses with extensive ED nursing experience. Figure 1 illustrates one of the five cases. Each patient case contained text describing the overall appearance and the chief complaint of patients arriving in the ED and requiring initial triage by a nurse.

> A woman and a man come walking to the ED. The woman, in her middle age, helps the man, who seems to be in his 80's, to take a seat in the chair in front of you. You look at the man and find nothing remarkable with him: he looks around but says nothing. The woman informs you that she works in a health care facility for people with dementia, as a health care worker, and that the man is a resident in the facility. The health care worker states that the man, some how, has changed since yesterday evening and that the health care personnel do not know what is the problem with him.

Figure 1. Example of patient case used

After obtaining informed consent from each participant, the TA data was collected in a quiet setting in the following manner. Following a brief period of practice using TA, participants were given the first of the five written scenarios and instructed to read it aloud and then think aloud while reasoning about how the nurse would handle the patient in a real life situation. While reasoning, the participants were told to continuously verbalize their thoughts; and whenever they stopped verbalizing for more than a few seconds, the investigator prompted them to "keep talking". Once they were finished reasoning about a particular scenario, participants were given the next one of the five, in turn, until all scenarios had been used. After the last of the TA data had been collected from each participant, they were asked follow-up questions by the investigator and their responses were also audiotaped, in the same manner as the TA data. The TA audiotapes were then transcribed verbatim prior to being imported as rich-text files into a QRS NVivo© project to manage the data and ease the burden of the PA. Initially, three of the 16 verbal protocol (TA data) were analyzed by hand, to identify and code all of the nouns and noun phrases in the verbal protocols (RPA), due to the PI's unfamiliarity with both PA and QRS NVivo©.

Before commencing the PA, the TA protocols were segmented into lines representing a single thought or focus of attention, based on guidelines described in the literature by Kuipers and Kassirer. [1] After the transcripts were segmented, they were examined line-by-line to identify and code all noun and noun phrases that represented either the information concentrated on or information sought (Step 1, RPA). The concepts that these nouns and noun phrases represented were coded inductively, and with their definitions were created by using a standard dictionary that identified the common meaning of these terms (see Table 1 for examples of coded concepts and their definitions).

Following the completion of RPA by hand for three verbal protocols, the codes identified were then reproduced (as Nodes) in an NVivo project, using the definitions to create the Nodes descriptors. The 16 transcripts of the TA data were imported into the NVivo project as rich text files, and then RPA was conducted on all transcripts in the NVivo project. Having performed this first step of PA, the data has been prepared for the next two steps: AA (which will allow the investigators to identify how the participants structured their thoughts during the triaging task) and SA (which will allow the investigators to describe the similarities and differences in the reasoning between the eight participants who had previously demonstrated advanced ability to make triage decisions and the eight who had shown limited ability to triage).

Table 1. Examples of Nodes and their definitions, and example from TA data.

Code/Node	Definition	Example from data
Duration	The time during which something exists or lasts	*How long; Two days*
Location	The site or position of something	*Around the muscles, wrists*
Status	The doing of something, state or condition	*Healthy previously*
Test	A method of examination to determine the presence or absence of a disease or condition	*EKG*
Symptom	Perceived by the individual only and not evident to the examiner	*Sore muscles, headache*

Findings

In many ways QRS NVivo© was helpful in conducting the complex and time-consuming PA. Any researcher who has ever completed PA by hand knows full well that the sheer amount and complexity of the process can be overwhelming. Many have used such tools as pens, paper, photocopiers, index cards, highlighters and cut and pasted sections of text to try to make sense of the verbal protocols and to make comparisons within and across subjects.

During RPA, a large amount of small text parts are being identified and coded, leaving several codes on each line of text. This can lead to a somewhat blurry document, but by using both the Coding Stripes and Coder in the QRS NVivo©, an overview is more easily achieved. However, the inability to have all Nodes visualized in different color settings at once, or to mark a word in the document and to easily see how the word was coded were some limitations experienced.

An advantage of using QDAS software to support PA is that it provides a database that enables researchers to keep a record of their ideas, searches and analytical steps. It also affords a means for examining specific sections of data through Node reports.

Another very useful feature of NVivo for PA is the Model Explorer that supports the creation of diagrams depicting how information (i.e., concepts--Nodes in NVivo) about triage was linked together in participants' verbal protocol (their verbalized thoughts) to form meaning that led to a triage decision. Identifying and describing the associations that are created in one's thinking during a problem-solving task is the primary goal of Step 2 of PA, Assertional Analysis.

The Node Report feature in NVivo will facilitate Script Analysis by providing details that will allow the investigators to make comparisons between the two categories of participants (i.e., those ED nurses who have been shown to triage well and those who have not). For example, by generating a report that contains all verbal protocol text coded as *Status* (as defined in Table 1), it will be possible to better understand how nurses conceptualize *Status* and to delineate the components that make up *Status* that influence ED nurses' triaging decisions. NVivo will also allow the investigators to generate of a report that tallies the total number of times that *Status* is coded in a single participant's verbal protocols, and across participants.

Conclusions

As the PA of the study discussed in this manuscript is being completed, NVivo has proven to be very useful for managing the verbal protocol data, for the coding of nouns and noun phrases in Referring Phrase Analysis and for generating coding reports and models that will facilitate Step 2, Assertional Analysis and Step 3, Script Analysis.

Research using TA and PA that identifies and describes nurses' cognitive processes provide important knowledge to guide system development. In the past, this type of research has been hampered by the onerous and complex task of PA. The investigators of the study discussed in this paper have found that QDAS has greatly helped to ease the burden of the challenging analytical process of PA, and they hope that as more investigators begin to use QDAS for this purpose, it will help to expand the methodological knowledge about this approach to meeting the challenge of Protocol Analysis.

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