Title: Comparison of 'think aloud' and observation as data collection methods in the study of decision making regarding sedation in intensive care patients

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Abstract

Background: There is recognition that different data collection methods gather different aspects of decision making data. Although the selection of a method to explore nurses' decision making is partially determined by the theoretical perspective that informs each study, some flexibility remains. Description of the relative benefits of each method will enable future researchers to selectively identify which method is most suited to answering their specific research question.

Objectives: To describe the decisions identified using observation and think aloud in the study of decision making related to sedation assessment and management within intensive care, as well as to examine the strengths and weaknesses of each method in the context of this study.

Design: Secondary analysis of data collected during an observational study.

Settings: This study was conducted in one intensive care unit in a tertiary teaching hospital in Australia.

Participants: Seven self-identified expert critical care nurses.

Methods: Nurses providing sedation management for a critically ill patient were observed and asked to think aloud during two hours of care, with follow-up interviews conducted up to four days later to clarify information collected. Data were analysed independently by an investigator not involved in data collection. Analysis involved identification of decision tasks with comparison of number and type of tasks identified with each of the two data collection techniques.

Results: Assessment and management were the most common types of sedation decisions made by nurses in this study. A total of 130 decisions were identified using observation and 209 decisions were identified using think aloud. More management

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decisions were identified through observation, while more assessment decisions were identified through think aloud.

Conclusions: The two data collection methods of think aloud and observation resulted in identification of different decision tasks. These results suggest an essential consideration in design of decision making studies is the method of data collection and the type of decision data that is likely to be identified. It may be appropriate to use a combination of data collection methods to optimise the completeness of data capture.

What is already known about the topic?

- The methodological approach used to study decision making should be informed by the guiding theoretical perspective

- Think aloud and observation have been effectively used to collect decision making data

What this paper adds?

- The number and type of identified decision tasks varied between think aloud and observation

- Think aloud identified more assessment decisions, while observation identified more management decisions

- The visibility of a decision making outcome should be considered when choosing a data collection method

Introduction

Greater understanding of the decision making processes used by nurses has the potential to lead to improved patient care through refinement of the cognitive strategies used (Taylor, 2000). Different approaches to the exploration of nurses' decision making have been used throughout the world and tend to cluster chronologically (Greenwood and King, 1995). From a theoretical perspective there has been a gradual progression, with rationalist and mathematically based frameworks such as Bayes theorem (Hammond, 1966) initially used. Later work made use of information processing theory (Elstein et al., 1978) and skill acquisition frameworks, as well as phenomenological approaches (Benner, 1984, Benner et al., 1996).

While the methodological approach that is used to study decision making is partially determined by the theoretical perspective that informs the study, there remains some flexibility in the data collection setting and process that are used. Again there has been progression, from an initial almost exclusive use of the simulated environment to recognition of the benefits of studying decision making in the natural setting (Aitken and Mardegan, 2000, Bucknall, 2000, Greenwood and King, 1995). During this period many different data collection techniques have been used including questionnaires, observation, retrospective verbal protocols such as interviews and concurrent verbal protocols such as thinking aloud.

Questionnaires provide a means of studying large numbers of participants, however the information obtained is retrospective and may be superficial. Retrospective verbal protocols facilitate retrieval of detailed information, including rationales, but remain dependent on the decision makers' memory and perception of the decision making

event. Both observation and concurrent verbal protocols, also known as think aloud, provide simultaneous means of data collection. Observation provides detailed information, particularly in regard to the outcomes of the decision making process. It has been shown to be effective in identifying decision making strategies, although has the potential to miss processes that are not observable (Benner et al., 1996, Gerdtz and Bucknall, 2001, McGarvey et al., 1999, Noll et al., 2001). Concurrent verbal protocols provide detailed information regarding both processes and outcomes, but have the potential to miss data if the participant ceases verbalisation of cognitive processes (Aitken and Mardegan, 2000, Fonteyn and Fisher, 1995, Greenwood and King, 1995).

Although there is recognition that different data collection techniques gather different aspects of decision making data, clear understanding of which technique, specifically observation or think aloud, should be used in each decision making setting is not always clear. If it is demonstrated that similar data are obtained using each of the data collection strategies then future decision making research need only use one strategy in order to obtain optimal information. In contrast, if it is demonstrated that differing data are obtained using each of these data collection strategies, the identification and description of these differences is beneficial. Such description would allow future researchers to selectively identify which type of data is most suited to answering specific research questions, and therefore, whether it is appropriate to use either or both data collection strategies.

Clinical practice scenarios that require ongoing assessment and management offer ideal situations to study the process of decision making due to the requirement for on-going decisions. Sedation and analgesia assessment and management within intensive

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care represents such a scenario. Indications for analgesia and sedation are multi-dimensional and constantly changing; they include pain, anxiety, delirium, the need to reduce oxygen consumption, sleep deprivation and facilitation of patient care, for example helping the patient to tolerate an endotracheal tube (Brush and Kress, 2009, Sessler and Wilhelm, 2008). Appropriate management of sedation and analgesia is complicated by the different pharmacokinetics of analgesic and sedative agents which are affected by physiological compromise and the treatment goals (Brush and Kress, 2009).

Given the challenges of providing appropriate sedation and analgesia management, and the multiple decisions that are likely to occur, this represents an opportune setting to study decision making and determine the appropriateness of the two data collection techniques of think aloud and observation. Therefore the aim of this paper is to describe the decisions identified using observation and think aloud in the study of decision making related to sedation assessment and management within intensive care, as well as to examine the strengths and weaknesses of each method in the context of this study.

Method

A naturalistic approach to data collection within the intensive care environment was used for the conduct of this study. Detail of the method used has been reported elsewhere (Aitken et al., 2009) but a brief review of the approach is provided here. Seven expert critical care nurses were asked to think aloud during two hours of care of an intensive care patient on one (n = 4) or two (n = 3) occasions during 2003 and 2004 in a tertiary teaching hospital in Sydney, Australia. Participants were a convenience

sample of registered nurses with more than five years critical care experience who self-identified themselves as experts in the field. Where nurses participated on two occasions, one of these was prior to and one following implementation of a nurse implemented sedation protocol. For the purposes of this analysis these episodes have been considered isolated episodes of decision making resulting in 10 episodes of data collection. Sample size was based on previous experience and publications using the two methods of data collection, with particular consideration of the depth of data collected and the participant numbers that had been required to achieve data saturation. Simultaneous data collection using observation and think aloud was undertaken by two experienced critical care nurses. Both data collectors had more than five years clinical experience in critical care, as well as experience as research assistants. The principal investigator trained both data collectors in the method of data collection to be used in the current study.

Permission to conduct this study was obtained from both the University and the Hospital Human Research Ethics Committees and participants provided informed consent. Although patients did not fill the role of a study participant in this study they received an explanation of the process, particularly in regard to the constant talking being undertaken by the nurse caring for them. This explanation was provided whether the patient was conscious or not, and was repeated at regular intervals based on the patient's level of awareness and was also provided to family and friends if they were present during data collection. If patients were conscious they were given the option to request that the 'think aloud' be stopped, and for all patients both the nurse caring for the patient and the data collectors had the option to stop data collection if

they assessed that the talking was causing distress to the patient. Data collection did not need to be stopped on any occasion.

Specific considerations related to the data collection included that the participant was required to think aloud for a period of two hours of care of a patient requiring assessment and management of sedation. Where possible this period of care was scheduled immediately after the commencement of a shift; during this time the data collector responsible for analysis of the think aloud data observed the participant for general activities that might have assisted with interpretation of the thinking aloud data but did not record extensive field notes. Simultaneously, a second data collector observed the participant and audio-recorded detailed commentary of the sedation assessment and management decisions they were able to identify, as well as any routine practices that were likely to help with interpretation of the data, such as the identification of patient goals during multi-disciplinary rounds.

Data obtained from both the think aloud and observation were independently transcribed, then each data collector returned to the participant for an independent retrospective interview within four days of the first stage of data collection. This retrospective interview was used to clarify and explain data obtained during the think aloud or observation period and each participant was asked to answer only the questions asked during the interview. The participants were specifically instructed to only answer the questions that each data collector posed and not to feel obliged to provide the same information to each data collector in the absence of relevant questions. Data from each retrospective interview was audio-taped and again independently transcribed.

Data analysis was conducted by the principal investigator who had not been involved in any data collection. All identifiers of participants and data collectors were removed from the transcriptions prior to analysis. Analysis involved reading the transcriptions for a sense of the care provided and decisions made, then highlighting the components of the transcript that related to assessment and management of sedation aspects of care. The decision as to whether an attribute or concept related to sedation was made by the principal investigator based on the situational context and any explanation provided by the participant during the retrospective interview. The sedation components of care were then extracted from the whole transcript, divided into separate phrases that each dealt with only one decision task. For the purposes of this study a decision was defined as the integration of information from one or more sources to produce an outcome; that outcome might consist of collecting more information, making a judgement about the adequacy of the patient's condition, taking no action, implementing treatment or any of the range of decisions outlined in table 1. After identifying decisions the category of each decision task was determined (see Table 1 for definitions of categories). The decision task categories were based on those proposed by Thompson and colleagues (Thompson et al., 2004) and adapted based on the work of Bucknall (Bucknall, 2000), together with the initial analysis of the data collected in this study. The decision tasks were then summed and compared between the two data collection techniques.

A significant amount of information concerning patient assessment was contained within the observation transcript. However, when reviewed carefully it was apparent that this information was the observer's assessment of the patient rather than the

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assessment performed by the nurse caring for the patient. For example the observer noted "she's very alert, her eyes are wide open and she looks very anxious" and "patient is lifting her head off the bed, and she's actually gagging on the ET tube, so very conscious". Although these data had the potential to aid data interpretation, the collection of such data had not been incorporated into the study protocol, but had been undertaken on an ad hoc basis by the data collectors. Due to the inconsistent nature of collection of these data they were not included in this analysis.

Inter-rater reliability of analysis was assessed by the principal investigator and one other investigator independently analysing data for four participants. Agreement for each method of data collection within each participant ranged from 78 – 100% with average agreement of 92%. Where agreement was <100%, full agreement was reached in all instances following discussion between the investigators.

Results

Seven expert critical care nurses, aged from 29 to 50 years with between five and 23 years critical care experience, participated in this study. Initial qualifications included both a hospital certificate (n = 3, 2 subsequently completed a Bachelor's degree in nursing) or a Bachelor's degree in nursing (n = 4) with all seven participants having also undertaken a speciality course in critical care nursing at the Hospital Certificate, Graduate Certificate or Graduate Diploma level.

The most common types of sedation decisions made by RNs in this study focused on the assessment and management aspects of patient care. For the majority of participants, more decisions were identified through think aloud than through

observation (Table 2). In general, more management decisions were identified through observation, while more assessment decisions were identified through think aloud (Figure 1). Although diagnostic decisions were relatively infrequent in this study, only one diagnostic decision was identified using observation while eight diagnostic decisions were identified using think aloud. Similar trends, with fewer decisions identified through observation than think aloud, were in evidence for both planning and evaluation. Overall think aloud led to 79 more decisions being identified than observation, an increase of 61% from the total of 130 decisions identified using the observation approach to data collection.

Discussion

Think aloud and observation are two data collection methods that have been used extensively to study decision making in health care. In the study reported in this paper the data obtained from each of these two collection methods varied, often quite significantly.

The collection of more assessment data using think aloud compared to observation is not surprising given Ericson and Simon's view that "there is a dramatic increase in the amount of behaviour that can be observed when a subject is performing a task while thinking aloud compared to the same subject working under silent conditions" (p. xiii) (Ericsson and Simon, 1993). The results of this study indicate that those decisions that do not necessarily involve overt behaviour, i.e. assessment, diagnosis and evaluation, are more fully captured using think aloud as a data collection technique. In contrast, management decisions that generally require a change in behaviour were equally well collected using both think aloud and observation. One of the distinctions frequently made in decision theory is to differentiate between judgements and decisions, where judgements involve 'an *assessment* between alternatives' and decisions involve 'a *choice* between alternatives'; the latter usually leading to an action (page 3) (Thompson and Dowding, 2010). Although this differentiation was not made in the definition of decisions used for this study it is reasonable to suggest that assessment, diagnosis, evaluation and planning decisions approximate judgements as defined above, while management, clarification and seeking help decisions usually result in an action and are therefore similar to decisions as defined above. Consistent with this distinction, more assessment, diagnosis, evaluation and planning decisions (i.e.

judgements) were identified using think aloud, while similar numbers of decisions were found in the other categories of decisions.

No other reports comparing the two forms of observation and think aloud data collection could be located, however one report of a comparison between concurrent and retrospective verbal reports was located (Whyte et al., 2009). This study identified significantly more observational, action, etiologic and predictive statements in concurrent verbal reports than retrospective verbal reports when studying a simulated ICU process of care. The differences in both the study reported in the current paper and that by Whyte et al (Whyte et al., 2009) emphasise the strong need for determination of the nature of the decisions a researcher hopes to identify before confirming the data collection method.

Considerations that became apparent during the conduct of this study include the technical quality of the data collection method, the nature of the topic being explored and the relative strengths and weaknesses of the data collection method. Each of these factors has the potential to significantly influence the data being collected.

Technical quality of the data collection method
The quality of the data collection method can be affected by many different features including the quality of the equipment, predominantly the recording devices used, the skill of the study participant in thinking aloud and the bias of the observer.

High quality audio recording devices are essential. Features that should be considered include clear recording of the participant's verbalisations, minimal recording of

background noise and long periods of recording without interruption, for example with digital recorders (Lundgren-Laine and Salantera, 2010). Clarity of recording can be optimised by use of a high quality microphone that is placed as close as possible to the participant's mouth, for example collar mounted.

In order to optimise the quality of the think aloud data that is collected it is essential to specifically instruct participants in the level of detail that is required. In this study participants were clearly instructed to only verbalise thoughts as they came to mind and not try to explain their thinking. Participants were also asked to practice beforehand to familiarise themselves with the process – a common practice exercise is to ask participants to count the number of windows in their home (Aitken and Mardegan, 2000, Lundgren-Laine and Salantera, 2010).

Verbal protocols are best suited to high level complex tasks that take more than a few seconds to process (Payne, 1994). Given the relatively quick and simplistic nature of each of the assessment and management actions related to sedation and analgesia it may be that use of think aloud is not optimal in this situation. However, if for the purposes of an investigation, assessment and management is considered to be an ongoing process that takes place within the context of all nursing care of the critically ill patient think aloud is uniquely suited to this context.

Although each of the data collectors in this study were trained in both data collection techniques, the potential for bias during observation became apparent during analysis. Effective observation of decision making required that the observer only document what the study participant was actually doing, not what the observer noted in regard to

the patient and/or surroundings. The potential for bias in recording was likely exacerbated by the unstructured nature of the observation that was used in this study (Pretzlik, 1994), although naturalistic observation has been demonstrated as an effective method of data collection in care related to pain management (Bucknall et al., 2007). In addition, both data collectors were familiar with critical care practice and this may have influenced the data collection, either by noting gaps in practice or alternatively through better understanding of the practices that were linked to sedation assessment and management (Lundgren-Laine and Salantera, 2010).

This study used an unstructured non-participant observational method, with data collection primarily via a tape recorder, although the observer had note paper available if they wished to document addition prompts or important events. This combination of recording appeared to meet data collection needs in the complex ICU environment while still allowing flexibility to cope with differing patient needs and responses. The positioning of the observer, in this case in a corner of the ICU where they were not in the way of routine activities, appeared to help with the participant continuing in their usual practice, with frequent comments during follow-up interviews indicating they 'forgot the observer was there'. Consideration of the data to be collected and the consistency and flexibility of the study scenario are essential when planning observational method (Pretzlik, 1994).

Nature of the topic being explored
Sedation and analgesia assessment and management did not appear to be as overt in nature as some other aspects of nursing assessment, for example hemodynamic assessment. Arguably there are few activities other than assessment of pain intensity

and sedation level and the administration of medications that can be solely attributed to sedation and analgesia assessment and management. Many other activities, for example repositioning, reassuring the patient and providing information may be related to this aspect of nursing, or may be related to aspects such as respiratory management and discharge planning. Sedation and analgesia assessment and management is frequently not given the priority that some other aspects of care are given, although deterioration due to extreme agitation can represent a priority in care in some circumstances. In addition, much of the assessment that takes place uses non-verbal techniques and is subjective (Gerdtz and Bucknall, 2007), with formal scales frequently not being used for assessment in this field of practice. Sedation and analgesia assessment and management is possibly an area of practice that is affected by the expertise of the critical care nurse – nurses with limited expertise may not yet appreciate the importance and impact of effective care in this area (Funkesson et al., 2007, Hoffman et al., 2009). While it is acknowledged that the participants in this study were self-identified experts, it is likely that they all had differing levels of expertise in sedation assessment and management. Although data analysis used the broadest definition of sedation and analgesia assessment and management it is possible that relevant aspects of care were not identified during the data collection and analysis process.

In addition, although isolated components of care such as increasing analgesia or assessing a patient's sedation level are relatively quick and simple activities that may be equally well undertaken by most critical care nurses, expertise in the full range of sedation and analgesia assessment and management may not be something that most critical care nurses have developed. As a result, although participants in this study

were self-nominated experts, it is likely that expertise, and consequently decision number and type, would vary between participants even if they were practicing in identical scenarios. The nature of the decision task being explored is also related to the decision making setting. Data collection in decision settings that are noisy, information rich, constantly changing environments (such as ICUs) may be more suited to certain collection techniques than decision settings that are more constant and ordered. The nature of the decision task, as well as the characteristics of the decision setting, affect both the number and type of decisions being made(Hammond et al., 1987) and therefore should be essential characteristics to consider when determining the data collection method.

Strengths of each data collection method

Each of the two methods used in this study had strengths that should be considered when deciding on an appropriate data collection method. Think aloud is not open to different forms of interpretation, but remains true to the exact verbalisations that are provided by the participant. In addition, think aloud is a relatively robust method of exploring decision making as it does not appear to affect performance providing no explanation of actions is required (Henry et al., 1989). Participants in this study frequently commented that they became oblivious to the microphone quite quickly and this is supported by the lack of formal expression noted during the recording process.

In contrast, observation does not rely on any form of self report by the participant, therefore potentially is open to less bias during the data collection process. Coupled

with a follow-up interview to confirm the interpretation of the observer, this form of data collection provides a robust method of exploring decision making.

Limitations of each data collection method

The data collected during think aloud may be limited if participants find continuous verbalisation difficult. Although all participants were offered practice, not all participated in this practice. Compulsory practice sessions should be considered as this offers the participant the opportunity to become familiar with this type of data collection and also provides the opportunity for coaching that is not possible during data collection. In addition, the disjointed nature of sedation and analgesia assessment and management meant that a follow-up interview was essential to ensure different aspects of decision making and care were linked together in an appropriate manner.

The obvious limitation of observation is that this method of data collection is dependent on visible activities occurring, the making of decisions does not always result in observable behaviours and could therefore lead to systematic under-reporting of decisions. Observation is also subject to observer bias as outlined above, appropriate training of the data collectors can help to minimise this bias.

Strengths and limitations of the study

The strengths of this study lie in the examination of one area of practice, in other words the assessment and management of sedation and analgesia needs. The use of interview to follow-up both the think aloud and the observation data collection is also a strength. Few studies have examined the decision making practices that surround core nursing activity within the natural setting and this study continues to grow our

understanding in this area. Participants were not made aware that the focus of data collection was sedation and analgesia practice, but understood the focus to be broadly critical care nursing. Hence there is no reason to believe that additional focus was placed on this area of practice. In addition, the use of independent data collectors for each of the think aloud and data collection method reduced bias in the data collection, both in the content and amount of data collected.

Despite these strengths, the associated limitations should also be considered. This study was not designed for the results to be broadly generalisable. Important considerations include the small sample size, the likely large variability in required decisions between each patient and the different skills and experience of the nurse participants. It is possible that a longer duration of data collection may have revealed more detail in assessment and management practices in this area as care is likely to be an on-going process of trial and error based on how the patient responds and reacts at different times and during different interventions and how well the nurse knows the patient in regard to reactions and requirements.

Conclusion

The study of clinician decision making represents a complicated research process that requires the consideration of multiple factors. Aspects such as whether to use a natural or simulated setting and whether to study a narrow or broad area of practice are essential elements of the design. The results of this analysis suggest an essential consideration is the method of data collection in relation to the area of practice and the type of decision data that is likely to be identified. In many situations it may be

appropriate to use a combination of data collection methods, for example think aloud,

observation and follow-up interview, to optimise the completeness of data capture.

Table 1 - Decision categories (Bucknall, 2000, Thompson et al., 2004)

Decision Category	Description
Assessment	Deciding that an assessment is required and/or what mode of assessment to use, including the decision to seek further information through patient assessment
Management	Deciding to deliver a particular intervention
Diagnosis	Classifying signs and symptoms as a basis for a management strategy
Planning	Determining what future assessment or management might be required
Evaluation	Deciding to collect information or combine multiple pieces of information to determine the effectiveness of a previous intervention
Clarification	Seeking further information from various sources to add knowledge or understanding prior to making additional decisions
Seeking Help	Requesting assistance from a colleague

Table 2 – Summary of decisions identified

Episode no.	1		2		3		4		5		6		7		8		9		10		Total	
Categories	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs	T/A	Obs
Assessment	18	9	1	0	7	2	13	3	8	7	10	7	8	10	6	2	15	4	5	4	91	48
Management	13	16	1	0	12	6	1	5	5	1	11	9	1	8	1	10	8	9	0	2	53	66
Diagnosis	2	0	0	0	0	0	1	0	1	1	2	0	0	0	0	0	1	0	1	0	8	1
Planning	4	2	1	0	6	4	2	1	0	0	7	3	2	1	0	0	3	0	1	0	26	11
Evaluation	1	0	0	0	8	1	3	0	3	1	3	0	0	0	3	0	7	0	0	0	28	2
Clarification	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Seeking Help	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	2
TOTAL	40	29	3	0	33	13	20	9	17	10	34	19	11	19	10	12	34	13	7	6	209	130

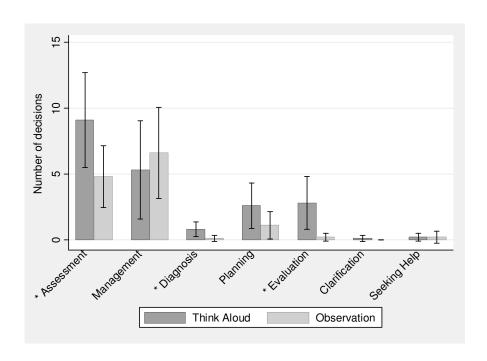Key: T/A – think aloud; Obs – observation

Figure 1 – Mean number of decisions (with confidence intervals) identified in

each decision scenario

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