CLINICAL DECISION MAKING IN DISTRICT NURSING

Catherine V. Winfield (B.Nurs.) RGN RHV DNCert.

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European Institute of Health and Medical Science
University of Surrey

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ABSTRACT

The two studies described here address the question of how District Nurses determine patients’ nursing problems and plan care. The theoretical framework for the investigation is derived from Information Processing Theory. A process tracing methodology was used to capture the content of District Nurses’ thinking during an assessment visit to a newly referred patient. Data was collected in the natural setting to ensure ecological validity. The assessment visits were tape recorded and immediately following the visit a stimulated recall session was conducted in which the nurse was asked to describe her thinking during the assessment, prompted by the tape recording. This session was itself tape-recorded. Thus two verbal protocols were elicited for each assessment: a visit protocol and a recall protocol.

Data were analysed by content analysis. The verbal protocols were assessed to ensure that they met the criteria for validity and reliability of the coding schedules was established using two measures or interrater reliability.

The first study sought evidence of hypothetico-deductive reasoning by nurses and describes the type of decisions made by nurses. Although evidence of hypothesis generation and testing was found, nurses’ knowledge was found to determine how they interpreted data initially and what data they sought. It was therefore concluded that a model of diagnostic reasoning that focused on cognitive processes alone was insufficient to explain the dynamics of clinical problem solving.

The second study, therefore, sought to establish the structure and content of District Nurses knowledge and the cognitive processes they used during an assessment. The
results suggest that nurses attend to both clinical and personal phenomena in order to make a judgement about the state of the patient and that their knowledge is organised internally as schema. This provides an explanation of how nurses recognise salient information and determine what further data is required. Four key cognitive activities were identified: search, inference, action and plan. The study concludes by drawing a line of reasoning to show how nurses integrate knowledge and reasoning processes to accomplish clinical problem solving.
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INTRODUCTION

The vast majority of health care has always been delivered outside a hospital setting but recent policy has created an increased emphasis on primary care, Choice and Opportunity – Primary care: The Future (Department of Health 1996), Primary Care: Delivering the Future (Department of Health 1997). This policy shift reflects the fact that Primary Health Care Teams have seen a significant change in both the nature and the volume of their work over the last few years. For instance, there has been a rise in both the number and the frailty of elderly patients in their care. At the same time patients' length of stay in hospital has significantly reduced and they are discharged back to the care of the Primary Health Care Team much earlier. This has led to the delivery of care in the primary care setting that was previously carried out in hospitals.

Against a backdrop of increasing and changing work it is important to understand the skills and expertise required to meet the challenge of delivering effective patient care. Sound clinical decision making underpins every aspect of practice and a fundamental skill is that of correctly identifying a patient's problems and planning appropriate intervention. As a practising District Nurse, the approach taken by District Nurses to assess patients' needs and thus plan care seemed to the researcher critical to the outcome of patient care. Indeed, Florence Nightingale (1860) stated that the "trained power of attending to one's senses, so that these should tell the nurse how the patient is, is the sine qua non of being a nurse at all". Kelly (1964) also talks of nurses "observing the patient, making inferences based on these observations and then taking appropriate action" and considers this to be "the heart of professional nursing". Decisions made during this process are critical, not just to patient well-being, but also
to the use of resources. How frequently a nurse visits, which member of the nursing team she deploys, what investigations she commissions and what treatment she prescribes will all impact on the level of resources consumed.

In District Nursing the first visit undertaken to a newly referred patient is known as an “assessment visit”. The aim is to identify the patient’s nursing problems and plan nursing action. As good practice is clearly based on sound judgement at this point it is important to examine and understand how this is achieved. Kratz’s (1978) study of the care of the long term sick in the community found that nurses gave “different levels of care to patients having apparently similar disabilities”. This finding suggests that clinical decision making by nurses may be inconsistent and consequently unreliable. The focus of the two studies described here was therefore to examine the nature of clinical decision making in District Nursing and describe the cognitive processes used to identify the patient’s nursing problems.
CHAPTER ONE

INFORMATION PROCESSING THEORY: A THEORETICAL FRAMEWORK

1.0 NURSING AS A PROBLEM SOLVING PROCESS

The research question addressed in this study developed from an interest in the way in which District Nurses identified what nursing problems a patient had and what care they required. This issue was considered to be important from a number of perspectives. Firstly, from the patient's perspective it is important that nurses can accurately identify those problems which require nursing intervention. Secondly, from a professional perspective it is important to understand and make explicit the skills required for effective assessment so that such skills can be taught and developed. Thirdly, the decisions about nursing intervention, based on judgements about the patient's problems, have considerable implications for the use of resources - the frequency of visits and the type of staff to be deployed, for example.

The assessment of new patients by District Nurses thus became the focus of concern. Kratz's (1978) study of the long term sick in the community has already been cited. She found that patients who had similar conditions received different levels of care and when this trend was explored she found no evidence to suggest that nurses used a problem solving approach to identify their patients' problems and plan subsequent care. She anticipated that "assessment of needs might not be systematic and that little concrete account of it would exist". (Kratz 1978).
Following the completion of Kratz’s (1978) work the nursing process was implemented in the U.K. The nursing process was developed in the USA to provide a systematic and purposeful framework for the delivery of nursing care. It was first described by Yura and Walsh (1967) as having four distinct phases: assessment, planning, implementation and evaluation. The impact of the nursing process in the UK was widespread as it became the organising principle on which nurses training and education was based. By the mid-eighties the majority of health authorities had implemented the nursing process in district nursing. In the UK McFarlane and Castledine (1982) identified a fifth step at the beginning of the process: data collection. They suggested that the assessment step involved the “identification of patient problems” and that the tasks involved were:

i) reviewing the date

ii) inferring meaning from the data based on known theory and research

iii) making judgements based on data.

During the 1970s American authors such as Bloch, Roy and Aspinall began to describe a new phase in the nursing process. This was known as the diagnostic phase and it occurred between assessment and planning. The phrase nursing diagnosis equates to the activity described by British authors as problem identification. Bower (1977) suggests that nursing diagnosis “identifies the clients problems ..... in relation to nursing practice”. Atkinson and Murray (1983) defines a nursing diagnosis as “a statement of a present or potential problem that requires nursing intervention in order to be resolved or lessened".
This newly defined diagnostic phase came to be regarded as the most important step in the process. Griffith–Kennedy and Christensen (1986) described it as the “key part of the nursing process – a basis for planning and intervention.” For Putzier and Padrick (1984) it is the “pivotal factor”. At the end of the diagnostic phase, Gordon (1982) suggests that the nurse should be able to identify the patient’s problem(s), their aetiology and the relevant signs and symptoms. An understanding of the aetiology of the problem is considered important for planning appropriate nursing intervention, whilst identifying the signs and symptoms associated with the problem provides a basis for evaluating the impact of nursing intervention and the progress of the patient. The assessment of patients in order to decide what their nursing problems are is thus the vital antecedent to the other stages of the process.

It could be argued that the term diagnosis describes the process of using the available information to decide which of several possible patient states pertains. As discussed above, the process of making a diagnosis enables the nurse to specify the patient’s nursing problem and lays the foundation on which decision making about intervention is based. Reaching a diagnosis is an example of the type of decision making cognitive psychologists refer to as problem solving. This has been extensively described by Newell and Simon (1972) and given the focus of this study it is helpful to examine the nursing process in the light of this work.

Because of the emphasis given to the systematic identification of patient’s problems the nursing process has been equated with problem solving. The use of this term has created confusion with the literature in cognitive psychology where problem solving describes the process individuals use to construct an internal model of problem they
are presented with and the strategies they use to move through the problem solving task. Underpinning the study of problem solving behaviour is a raft of empirically derived knowledge of perception, memory and learning. Lack of reference to the literature from the field of cognitive psychology make the nursing process vulnerable to criticism on a number of points. However, it should be said at the outset that the original concept of the nursing process has been diluted in its implementation in practice. Miller (1985) states that, “it appears that nursing process in theory and nursing process in practice are often very different and that practice often includes the method but not the underlying beliefs and principles”. In the early stages of the debate, as discussed previously, there was some concern to identify the steps in the nursing process but the conclusion was eventually reached that the process was cyclical rather than linear. This view is encapsulated by Mortiz (1980) who suggests, “instead of being a structured series of steps, each process is an expanding spiral of interchanging thought and activity, the components building upon and contributing to each other in a dynamic fashion”. However, in the course of implementation this message was lost and the documentation used supported a linear approach.

A review of the literature, using cognitive psychology as a theoretical framework, suggests that the assessment process in nursing is an example of a problem solving task wherein the nurse is confronted with some information relating to the patient about which she needs to make a judgement in order to determine the requirements for nursing care. Thus the process of diagnosis, or identifying the nursing problem, is seen as a problem solving task. Crow et al (1995) describe the solution to the problem solving task as “a judgement or evaluation which enables the nurse to select the appropriate care (interventions) in order to look after the patient”. They defined a
judgement in this context as “a statement which expresses the nurse’s estimate of someone’s condition or situation”. Thus it is important to distinguish between the term diagnosis when used to describe the process of identifying a nursing problem and the term diagnosis when used to describe a judgement or conclusion at the end of the problem solving process. Having established that the assessment task in nursing is an example a problem solving task, the theoretical approaches to studying problem solving and decision making are outlined below.

### 1.1 THEORETICAL APPROACHES TO THE STUDY OF PROBLEM SOLVING AND DECISION MAKING

The theoretical framework chosen for this study comes from information processing theory, first described by Newell and Simon (1972). This theory is a descriptive theory of human reasoning and postulates that reasoning consists of a relationship between the problem solver and the task environment, or the context in which the problem is being solved. It thus provides a useful framework for the study of the problem solving task involved in determining a patient’s condition. Other approaches used in the study of judgement and decision making are considered below.
1.1.1 Normative theories

Normative theories are based on the premise that the problem solver is a rational being who employs the type of thinking that will best lead to the achievement of a goal. The study of thinking from this theoretical perspective therefore involves comparing the judgements and decisions of the individual with some normative standard of what they ought to be. The purpose is to produce recommendations for optimal decision making and therefore the focus is the characteristics of the decision task rather than the behaviour of the decision maker.

1.1.2 Prescriptive theories

A key characteristic of a decision making task is uncertainty, either of information or of outcome. It is not always possible to measure the outcome against objective criteria to determine whether a decision is correct as it may depend on personal preference and choice. However, prescriptive theory attempts to impose a logical structure on the task in order to determine the consistency of a set of responses. The prescriptions for consistent behaviour are based on formal probability theory and Expected Utility Theory.

Prescriptive decision theory provides a set of rules for combining beliefs or probabilities and preferences or utilities in order to make a choice.

Prescriptive models have been successful in describing simple, automatic processes, but less successful in describing judgements that require thoughtful deliberation.
Thus, with regard to clinical decision making, Kassirer et al. (1982) suggest that
decision analysis may not be a useful approach. Clinical decisions take place in
situations where data may be missing, where many options are possible or where
alternative actions may be unclear. As such, clinical problems are difficult to subject
to formal decision analysis. A number of further criticisms have also been made.
Hogarth (1982) challenges the desirability of consistency as a principle, suggesting
that inconsistency may have desirable properties, while forced consistency may
inhibit the search for creative solutions.

Ample evidence exists to demonstrate that judgements depart significantly from the
prescriptions of formal decision theory. Decision making processes vary between
different task environments and an individual might use any number of strategies to
arrive at a judgement or decision (Hammond 1980). Indeed Pitz and Sachs (1984)
suggest that the failures of the algebraic model have themselves provided interesting
findings. For instance, Wallsten and Budescu (1981) found that failures of the
additive model occurred most frequently amongst experts, presumably because of
their ability to use more complex rules. Hammond’s Cognitive Continuum Theory
(Hammond 1980) postulates that an averaging process is an intuitive strategy that is
more likely to be used when the task is complex and unfamiliar. This hypothesis is
supported by Wallsten and Barton (1982) who suggest that subjects use a two-stage
judgement process; the first stage, similar to Hammond’s intuitive processing, leads to
a tentative judgement; the second incorporates a more complex, configural analysis.
1.1.3 Descriptive approaches

Variation in decision making processes from the prescriptive model led investigators to examine more closely the information processing strategies and heuristics people use when undertaking a problem solving task. Interest in cognitive function (processes and strategies) developed in the light of two key findings. Firstly, that judgements can change according to the nature of the task and the way it is presented and secondly, that people use strategies to simplify complex problems solving tasks. In support of these two findings is evidence that successful problem solving is task-dependent and that a common approach required by the prescriptive models is not present.

To understand the problem solving process the characteristics of problems themselves must be examined. Duncker (1945) suggested that “a problem arises when a living organism has a goal, but does not know how this goal is to be reached”. Each problem has three essential elements: a starting state, a goal state and a set of processes or operators that can transform one state into another as the problem solver works through the task (Garnham and Oakhill 1994). At the outset of the problem solving task the problem begins in a certain state in which certain conditions and pieces of information are presented. The goal state is the desired end state of the problem and thinking is required to transform the problem from the starting, or given, state to the goal state. The complexity of problems varies according to how well defined they are. Reitman (1965) suggests that problems can be assigned to one of four categories:
- well defined given state and well defined goal state
- well defined given state and poorly defined goal state
- poorly defined given state and well defined goal state
- poorly defined given state and poorly defined goal state

Clinical problems are generally considered to be ill defined the goal state e.g. the medical or nursing diagnosis or judgement of the patient's state, needs to be identified by the problem solver and the degree of information available at the start state is variable. In ill defined problems the problem solver has to help define the problem. The ability to do this depends on the subject's own knowledge.

According to information processing theory (Newell and Simon 1972), the mental representation of a problem which an individual creates is known as the problem space. The subject moves through the problem space by going through a series of knowledge states. These are characterised by the information the person has available at each point in the task. Knowledge states are transformed by applying mental operators to move from one knowledge state to the next.

The process of problem solving can thus be described as sequence of mental transformations of problem states until the goal is achieved (Huber 1989). The problem solver must select operators to effect these transformations. Operators are divided into two types: algorithms and heuristics. An algorithm is a set of rules which, if followed, will always generate the correct solution e.g. the rules of maths. Heuristics are more akin to rules of thumb. They are procedures or outlines for searching for solutions which are relatively easy to use. Their use may be based on
their effectiveness in solving previous problems. Within information processing theory the selection and evaluation of mental operators are known as “heuristic search strategies” (Newell and Simon 1972).

Within the field of information processing there are broadly two areas of interest. The first relates to cognitive function and the heuristics and strategies people use to work through the problem solving task. The second concerns cognitive structures, in particular the organisation of knowledge and how it is stored and the way in which people create internal representations of the problem to be solved.

A key factor which limits the capacity for information processing is the structure of human memory. The current view is that there are two systems of memory which hold different types of information for different lengths of time. The short term, or working memory, has a small capacity in which presenting information is stored and processed with information retrieved from long term memory, which has a large capacity. Miller (1956) describes the limitations of short term memory as seven items plus or minus two. The amount of information held in working memory can be increased by grouping or “chunking” related items (Newell and Simon 1972). In problem solving the subject attempts to reduce cognitive overload by utilising strategies which will guide the search for possible solutions and reduce the number of options requiring consideration.

In summary, the problem solving process can be seen as having three key elements. First there is the handling and acquisition of information which comes from two sources: the external environment and internal sources, in the form of knowledge
stored in long term memory. The second element is the internal representation of the problem by the problem solver, or the problem space. This is determined by the type of problem and the goal of the problem solving process. The third element in the process comprises the strategies or heuristics used to progress through the problem solving task. This thesis traces the development of knowledge about the processes involved in clinical reasoning from the early view that there was one problem solving process to the current view that the strategies employed in solving clinical problems vary according to the particular task and the problem solver's expertise. Section 1.2 describes the model of hypothetico deductive reasoning (Elstein et al 1978), which was developed within the framework of information processing theory, to describe the clinical reasoning of physicians.

1.2 HYPOTHETICO-DEDUCTIVE REASONING

Early studies of clinical reasoning sought to identify a single model of problem solving (Elstein et al 1978). It was considered that clinicians used hypothetico-deductive reasoning during the diagnostic task. This type of reasoning was said to be characterised by the early generation of hypotheses, followed by a hypothesis directed data search until a final hypothesis was accepted. Early hypothesis generation seemed to explain the way in which problem solvers were able to narrow the field of possibilities (Gordon 1982) and thus reduce cognitive strain (Jones 1988).

Key pieces of work in this area are the Michigan Medical Inquiry Project (Elstein et al 1978) and the McMaster studies (Barrows et al 1978). Elstein's work consisted of a series of studies which led to a descriptive analysis of the reasoning process of twenty
four clinicians. Elstein used a process tracing method in an effort to capture the thoughts, feelings, associations and strategies going through subjects’ minds whilst they were engaged in diagnostic reasoning. He used simulated patients and asked his subjects to think aloud during the diagnostic task. On completion he conducted a “stimulated recall” session during which he showed the subjects a videotape of their clinical interview and asked them to relate their thinking to a trained interrogator. His strategy was to identify the fundamental units of analysis appropriate to the study of medical reasoning, from the data collected. He sought to define the fundamental elements around which the solution to medical problems was organised.

He identified three fundamental units of protocol analysis: information search units, cues and hypotheses. Information search units were defined as any statement or act of the physician that either seeks information, instructs the patient concerning a procedure, or establishes rapport between the patient and physician. Cues were described as data or findings obtained by the physician’s enquiry. This could be any item of information about the patient such as their age, sex or presenting symptoms. Hypotheses were defined as “the physician’s formulations of possible solutions to the problem”. (Elstein et al 1978). They were concepts that had medical significance and were used to cluster cues. Information collected subsequently either verified or disproved the hypothesis that had been generated.

Elstein et al’s (1978) study appeared to suggest that clinicians generated hypotheses early and then interpreted data in the light of these hypotheses as the diagnostic process unfolded. Information subsequently collected was said to be used to evaluate existing hypotheses and possibly generate new ones. Each hypothesis seemed to
imply a set a probable features and cues were interpreted by evaluating their conformity to these specifications. As data was gathered hypotheses were said to be "ruled in" or "ruled out" until a final judgement was reached. As suggested earlier this type of reasoning represents a heuristic, or strategy, designed to minimise cognitive strain by generating hypotheses early in the task and thus reducing the options for consideration.

A number of investigators found evidence of early hypothesis generation. Dailey (1952) found that even if subjects knew that further information would follow this did not prevent them from constructing subjective hypothesis. Again the explanation put forward for this behaviour was that the subject identifies a possible end point in order to limit the size of the problem solving task. Peterson and DuCharme (1967) attempted to test this explanation. They presented subjects with information sequentially and without a break so that they would have minimal opportunity for hypothesis formation. However, subjects still showed a pronounced tendency to develop a hypothesis even on the basis of incomplete or erroneous data.

Formulation of a hypothesis in the early stages of the problem solving task has implications for accuracy. Gathering data or "cue acquisition", along with correct cue interpretation, is closely associated with diagnostic accuracy (Elstein et al 1978). Another consequence of early hypothesis generation, called the "primacy" effect, is that subjects are reluctant to discard their initial hypothesis when subsequent data challenges its accuracy. Pruitt (1961) found that considerably more information was required to modify the preliminary guesses made by subjects than for those in the pre-decision condition to reach a decision. Thus the time necessary to dispose of an
incorrect hypothesis is greater than that required for constructing an initial hypothesis. Obviously this has important implications for the diagnostic process. Inaccurate early diagnostic hypothesis will interfere with the ability of clinicians to reach the true diagnosis and will cause delay in the diagnostic process.

Early hypothesis formation also affects the way that subsequent data is interpreted. In a study by Kozielecki (1966) subjects received messages that both supported and disproved the favoured hypothesis. Of the messages that supported the hypothesis 95% were considered true, whereas only 27% of the messages that disproved the hypothesis were evaluated as true. Kozielecki (1966) argued that a person will settle on the first hypothesis among the set of available alternatives that exceeds a certain “hypothesis threshold”. That is when it’s probable truth reaches a certain minimal level. He described the subsequent evaluation of confirmatory or disproving evidence as true or false as “the mechanism of self confirmation of hypothesis”.

In summary, the literature suggests that hypotheses are generated, almost automatically, at an early stage in the problem solving process. Once established the initial hypothesis proves highly resistant to revision or disproof by subsequently received information. Consequently difficulties may arise in the problem solving process as a result of premature hypothesis formation and bias in the data processing. Despite this potential for error early hypothesis generation continues to be used as a strategy for reducing the problem solving task to a manageable size and minimising cognitive strain.
As a result of his work Elstein et al (1972) proposed a model of diagnostic enquiry composed of four major activities:

- cue acquisition
- hypothesis generation
- cue interpretation
- hypothesis evaluation

As noted earlier he found that diagnostic accuracy was associated with a higher percentage of cue acquisition and greater accuracy of cue interpretation. These two activities were also shown to be independent of one another. Hypotheses were shown to generated early in the process, about 10% of the way into the clinical interview. Rarely were more than five hypotheses entertained at any one time. Elstein et al (1972) suggested that the clinical interview consists partly of a guided search for other findings suggested by the hypothesis. In other words that following initial hypothesis generation, the subsequent cue acquisition is hypothesis directed. However, Elstein et al (1978) were unable to distinguish between hypothesis testing questions and routine questions, although they considered that clinicians reading the protocols were able to make this distinction.

According to this model cue interpretation is about assessing the data in terms of their fit to anticipated findings. Cues can be categorised as positive, non-contributory or negative with respect to a particular hypothesis. For the final step in the diagnostic reasoning process, hypothesis evaluation, Elstein et al (1978) attempted to discover
the rule that physicians used to make diagnostic decisions. Their subjects appeared to us one of two rules in the majority of judgements:

i) select the hypothesis with the maximum number of positive cues

ii) Select the hypothesis with the maximum difference of positive cues minus negative cues.

1.3 THE NURSING PROCESS

Returning to the discussion of the nursing process, it is noted that the implementation of the nursing process required nurses to collect significant amounts of data about the patient as a precursor to identifying patient problems. This prescribed approach would appear to contradict the way in which individuals naturally approach a problem solving task. Reasoning is characterised by the early generation of hypotheses and followed by a hypothesis directed data search until a conclusion is reached about what state pertains. McHugh (1987) argues that the rigid structure of the nursing process can inhibit this process, suggesting that the expert nurse’s experience allows her to “zero in” on one or two alternatives quickly and test them. She argues that this is still a problem solving process but that it has a looser structure which allows alternatives to be rejected without going through each step of the nursing process sequentially.

The process which McHugh (1987) is referring to is more akin to the hypothesis driven approach described by Elstein et al (1978). He suggests that the physician will acquire and interpret cues which in turn will lead to hypothesis generation. From the information available during a clinical encounter it is suggested that some cues will have particular relevance or salience in the light of the doctor’s clinical knowledge.
These cues will unlock that particular knowledge and trigger hypothesis generation. Gale and Marsden (1983) describe these cues as “forceful features” and suggest that “a forceful feature of some presented or elicited array of information is forceful mainly because it is a key to some array of information in the diagnostician’s memory”. It is suggested (Grant and Marsden 1987) that the identification of forceful features therefore leads to an initial clinical interpretation of information.

This evidence raises a number of questions about the process nurses use to identify patients problems. Firstly there is the question of cue acquisition and interpretation. It has been shown that this is a necessary antecedent to hypothesis generation. The nursing process, as it has been implemented in practice, with prescribed assessment schedules, may mitigate against this. There is also the question of whether nurses’ knowledge is structured so that forceful features can be identified and pertinent knowledge retrieved which, in turn, leads to hypothesis generation with its subsequent directed data search.

One possible criticism of the nursing process is that the underpinning framework for assessment is derived from one of a number of nursing models. Nursing models offered a variety of ways of viewing four key concepts in nursing: the individual, nursing, society or the environment and health. Thus according to Henderson’s theory of nursing (Henderson 1966) the nurse intervenes when the patient has a deficit in need fulfillment, in Orem’s model (Orem 1985) she intervenes when the patient has a self care deficit, in Roy’s model (Roy 1976) she intervenes when the patient has a reduced ability to cope with stressors. Significantly none of the models were empirically derived as Kriteck (1984) notes, “most nursing theories impacting on the
profession tend to describe how nursing "should" be, not how it is in reality....Indeed, most nursing theory reads like a prescription for the profession. Only rarely can a reader catch a glimpse of what actually is." Despite the fact nursing models had an "unreality" and "lack of utility" (Mcfarlane 1986) they were the only framework developed by the professional for implementing the nursing process.

One reason for the adoption of nursing models as an underpinning framework to the nursing process, might be that in order to assess patients and identify nursing problems nurses need to have a clear view about what they are actually looking for in the patient. They need to be clear about the nature of nursing itself, what constitutes a nursing problem and what interventions are appropriate in a given situation. Nursing models appeared to offer the answers to these fundamental questions. As McFarlane (1986) suggested, nursing models seemed to guide nursing action, indicate the type of nursing assessment required, and determine the goals of nursing care. They were considered to provide a conceptual framework which supported thinking during each stage of the nursing process. Possibly because nursing models provided a structure for the assessment process little attention was paid to understanding and making explicit the cognitive processes which underpin clinical reasoning.

To summarise the position, the nursing process, in the form in which it has been implemented, may be criticised for its approach to the assessment of nursing problems. The basis for this criticism is that it mitigates against the problem solving process described by cognitive psychologists which is cyclical and iterative rather than linear. It also ignores the requirement for a well structured internal knowledge
base which can be rapidly retrieved in response to relevant cues and is considered to be the basis for expertise.

However, it must be acknowledged that prescribed assessment schedules have some value in the clinical setting. Gale and Marsden (1983) studied the role of routine enquiry and concluded that it had a number of functions. It can act as a scanning or fail-safe mechanism for ensuring that nothing has been missed. An important principle in nursing is that nurses adopt a “holistic” approach to patient care characterised by a concern for any social, psychological and physical factors, beyond the presenting problem, which are amenable to nursing intervention. Part of the function of assessment is, therefore, to screen or scan for all problems that may contribute to the patient’s requirement for nursing care. Prescribed assessment schedules may have a role in supporting this function.

Although the nursing process has not been found to be a helpful vehicle in facilitating the development of understanding of clinical reasoning in nursing its contribution to the debate should not be underestimated. Its introduction led to recognition of the importance of accurate assessment of the patient’s condition (Griffith-Kennedy and Christensen 1986, Putzier and Padrick 1984, and Gordon 1982). From this, interest in the cognitive skills used in nursing developed which stimulated the study of how nurses identify patients’ problems and plan their care.
Research into clinical reasoning in nursing followed the approach of Elstein et al (1978) and sought evidence of hypothetico-deductive reasoning by nurses. Thus in an exploratory study Westfall et al (1986) sought to establish the extent to which Elstein's (1972) model of diagnostic reasoning portrayed the diagnostic reasoning of nurses. They examined one component of the diagnostic reasoning process – the activation of diagnostic hypotheses and other inferences. The term inference was used to describe any tentative conclusion which was based on, or went beyond, the cues presented. The following categories of inference were identified:

- Accurate diagnostic hypothesis
- Plausible but inaccurate hypothesis
- Implausible hypothesis
- Related hypothesis
- Nursing action inferences

The methodological approach involved eliciting think aloud reports from subjects during a simulated diagnostic reasoning task. The simulations consisted of a verbal change of shift report, a short video-tape scene of the patient and a complete set of pre-admission and current health data which was used in response to subjects' requests for additional information. The subjects were 28 nursing students and 15 practising nurses. After viewing the videotape, subjects were instructed to ask for more information as they would in real life. As they sought information they were instructed to "think aloud" or verbalise their problem solving processes. These verbalisations were tape recorded and transcribed for subsequent analysis.
Westfall et al (1986) found that both students and qualified nurses generated hypotheses and that this occurred early on in the work up. However, they did not find differences in the number of hypotheses activated, or the comprehensiveness, efficiency, proficiency or earliness of hypothesis activation between students and qualified nurses. More experienced nurses did however, activate more complex hypotheses.

In the main study which followed the exploratory study described above (Westfall et al 1986), Tanner et al (1987) concluded that the diagnostic reasoning processes of both qualified nurses and students could be described by Elstein’s (1978) model. They found that subjects activated diagnostic hypotheses early in the encounter and use systematic information gathering to rule in and rule out hypotheses. There was more systematic data acquisition and greater diagnostic accuracy amongst nurses with greater knowledge and experience. However, they found some evidence of task specificity in terms of the number of hypotheses activated and diagnostic accuracy whilst data acquisition strategies appeared to be more generalisable across cases.

In the U.K. Jones (1989) used information processing theory as the theoretical framework to study clinical reasoning by nurses assessing a patients. She used think aloud protocols to construct a Problem Behaviour Graph (PBG) which showed the subjects’ step by step progress during the problem solving task. Both Jones (1989) and Tanner et al (1987) propose that studies of nurses’ clinical reasoning are best conducted in the practice setting. Jones (1989) was obliged to reject this option because she used concurrent verbal reports to collect data on nurses thinking. It was
considered unethical and impractical to adopt this approach in the clinical setting. Fonteyn (1995) also suggests that the fullest and most accurate description of nurses’ clinical reasoning will be obtained when reasoning is studied in the clinical setting at the time it is occurring.

Because there had been virtually no research in the U.K. which sought to explore and describe the reasoning strategies of nurses and the concept of nursing diagnosis was in its infancy the first study described in this thesis sought to establish whether Elstein’s (1978) model of diagnostic reasoning described diagnostic reasoning in nursing. The aim of the study was therefore to test the hypothesis that in the course of assessing patients and identifying nursing problems District Nurses attend to cues, activate hypotheses and carry out a hypothesis directed data search until a final hypothesis is accepted.

Again because this was a relatively new area of investigation it was considered helpful to take a broader view of the nature of the decisions made by District Nurses rather than restricting the focus of the study to diagnostic reasoning. The findings of Westfall et al (1987), described earlier, were that nurses made inferences about nursing actions as well as diagnostic inferences. The second aim of the study was, therefore, to describe decisions other than the diagnostic decision, that occur during the assessment visit. The intention was to establish the types of decisions made by District Nurses and develop an understanding of the cognitive strategies used to identify patients’ nursing problems. In the light of recommendations made by other researchers (Jones 1989, Tanner et al 1987, and Fonteyn 1995) the study examined the clinical reasoning of district nurses engaged in assessing real patients in their
home. Chapter two reviews the methodological approaches that have been used to study clinical decision making.
CHAPTER TWO

METHODOLOGY

2.0 INTRODUCTION

The purpose of this chapter is to review the methodology approaches utilised in the study of clinical decision making. The first section examines the technique of process tracing which, as the name suggests, is an attempt to track an individual's cognitive processes through a problem solving task. The benefits and problems associated with this approach will be discussed and the issue of ecological validity considered. The second section will describe approaches to the analysis of data, in the form of verbal reports, which this approach yields.

2.1 PROCESS TRACING

Problem solving occurs when an individual is presented with a task which he has to work through to arrive at a solution — a game of chess, for example, or a diagnostic task. Process tracing is a methodological approach that is concerned with identifying the problem solver's cognitive processes. In studies of clinical decision making subjects are presented with real life or simulated patients and asked to complete the diagnostic task. Broadly two methods can be applied: observation and verbal reporting (Van Someren et al 1994).

In the first instance the researcher observes the subject undertaking a problem solving task. This provides the opportunity to witness the problem solving task occurring in its natural setting and enables the researcher to observe how the subject approaches
the task, in other words their starting point, what information they seek and attend to, the order in which they seek information and the speed at which they reach a solution. It provides some evidence for the cognitive processes the subject may be using but does not attempt to directly measure these.

A further approach suggested by Van Someren et al (1994) is that of dialogue observation. They note that some problem solving tasks naturally involve dialogues and that these can be recorded and used as verbal data about the process. Clearly dialogues have the advantage that they can be recorded in the natural setting.

The second class of methods involves verbal reporting by the subject of his cognitive processes. There are two main approaches to obtaining verbal report from subjects: concurrent verbal reports where the subject is asked to think aloud as they undertake a problem solving task and retrospective reports where the subject is asked to report on their cognitive processes after the task has been completed. Both these kinds of reports are considered to be direct verbalisations of specific cognitive processes (Ericsson and Simon 1993). This technique is based on the Information Processing Theory described in the previous chapter. The subjects verbalisations reflect the contents of the working memory and the “central processor” and the resulting report records the step by step progress made by the subject to the solution of the problem. Progress is characterised by passage through a series of knowledge states which are transformed by applying mental operators to move from one knowledge state to the next.
2.1.1 Criticisms of verbal reports

The use of verbal reports as data has been subject to a number of criticisms and it is important to review these here. There are broadly three areas in which this approach can be challenged. The first relates to constraints of the technique based on our knowledge of the architecture of the human mind. The second relates to the ecological validity of the approach and the third relates to the analysis of data yielded by verbal reports.

Nisbett and Wilson (1977) are critical of the approach on the basis that subjects cannot access their higher order cognitive processes accurately. They note that when asked to report on their cognitive processes subjects are unaware of the existence of a stimulus that importantly influences a response, unaware of the existence of a response and unaware that the stimulus has affected the response. They suggest that reports are based on subjects’ post event rationalisation of their cognitive activity, on a priori, implicit causal theories, or judgements about the extent to which a particular stimulus is a plausible cause of a given response. In answering these criticisms it is important to make the distinction between introspection and the technique of think aloud. The method of introspection requires subjects to theorise about their own thoughts and indeed to interpret their thoughts themselves. With the think aloud method subjects are not asked to theorise but simply to report what they are thinking whilst performing a problem solving task. There are no indications that think aloud protocols contain information made up by the subjects. Ericsson and Simon (1993) conclude that some distortion may occur if there is a time lapse between the actual cognitive process and the verbalisation of the process, giving room for interpretation or forgetting. This can occur with introspection where interpretation of thoughts.
before giving the report is part of the method and with retrospective reports where subjects are asked how they performed the task afterwards.

Harte (1994) also raises the question of whether cognitive processes can be verbalised and concludes that there are three factors which will determine how readily verbalisation will occur. The first is the notion of cognitive penetrability described by Pylyshyn (1989). Here the distinction is made between the machinery of a cognitive system and the information that is processed by that machinery. The machinery itself cannot be observed only the information residing in it can be observed or verbalised. In other words we cannot observe the way in which information is retrieved from long term memory, only that it is. This is similar to the argument outlined above that subjects can accurately report on the content of their thinking if not the process.

A second factor identified by Harte (1994) is the degree of automation of the task performed which is determined by the experience of the subject with the task. As the degree of experience increases the number of steps in the cognitive process will reduce to the extent that the think aloud protocol of an expert might contain only the end solution.

The final factor is the format of the information to be processed. Thus where visual information is to be processed thoughts require verbal encoding before they can be processed.
2.1.2 The effect of verbalisation on cognitive performance

A further criticism of verbal reports is one of reactivity, the idea that cognitive processes are affected by the act of thinking aloud. A considered response to the criticisms made of the use of verbal reports as data is given by Ericsson and Simon (1993) based on an extensive review of studies in this field. When addressing the question of whether verbalising during a task affects cognitive performance, they noted that in the normal course of problem solving people spontaneously verbalise without intending to communicate. An example of this would be the learning of skills like reading or arithmetic which is accompanied by overt verbalisation.

Ericsson and Simon (1993) did consider that the way subjects were instructed in relation to the think aloud task could affect their cognitive performance because it may influence the way in which information is heeded and therefore processed. Thus requests for selective verbalisation could lead to selective attention to the information presented. Equally, specifying the units to be verbalised could bias attention to those units. If a short time interval is given for producing verbalisations this may not correspond to the time during which information would otherwise be heeded. The pace of verbalisation required may also influence the duration of attention given to each item. Ericsson and Simon (1993) therefore concluded that whilst overt verbalisation under think aloud instructions will not affect the speed of performance, when subjects try to comply with specific instructions as described, the normal course of their internal processes are altered. They go on to suggest that verbalisation may indeed confer some benefit in that hearing overt verbalisation generally facilitates memory, retrieval and storage.
Ericsson and Simon (1993) distinguish between three levels of verbalisation. The first level is verbalisation of covert articulatory or oral encoding which require no intermediate processes. The second level of verbalisation involves description or explication of information that is held in a compressed internal format or that is not encoded in a language format such as visual stimuli or information about odours. This information requires some recoding in order to be expressed verbally. A third level of verbalisation requires the subject to explain their thought processes or thoughts. This explanation of thoughts, ideas and hypotheses goes beyond a simple recoding of information already held in the working memory and requires the linking of this information to earlier thoughts and information previously attended to.

A review of empirical studies of level two verbalisation was undertaken and Ericsson and Simon (1993) cite studies by Roth (1965), Karpf (1972), Walker (1982), Carroll and Payne (1977) and Johnson and Russo (1978), amongst others, which led them to conclude that the observable structure of cognitive processes is not affected significantly by the instruction to think aloud, provided the experimental conditions are consistent with the criteria for level one and two verbalisations. The only consistent effect of verbalisation on cognitive performance has been found to be the speed at which the task is accomplished. The process of thinking aloud, whilst not altering cognitive processes, does appear to slow them down.

Based on the findings of the studies they reviewed, Ericsson and Simon (1993) concluded that the effects, or absence of effects, of verbalisation on cognitive tasks were dependent on the characteristics of the task itself and the nature of the instructions given to think aloud. Where such instructions conformed to level one and
two verbalisation, there is no evidence that verbalisation changes the course or structure of thought processes.

2.1.3 The Completeness of Verbal Reports

Consideration was also given to the completeness of verbal reports. The model that Ericsson and Simon (1993) describe, based on the theory of information processing, assumes that only information in focal attention in the working memory can be verbalised. Information processing theory allows for the distinction between fast, automatic processes, that are not necessarily conscious and slow, serial processes that are cognitively controlled.

As experience increases the same task may move from being cognitively controlled to an automatic process. Thus, as suggested earlier the expert may be unable to verbalise cognitive activity which is available in working memory to the novice.

In addition to the particular difficulty associated with expertise, there is a general concern that the cognitive behaviour underlying verbal reports may be unconscious and therefore not available for verbal reporting. There is also the possibility that verbalisations, when they do occur, are not related to underlying cognitive behaviour and may not be veridical reports of the subject's thought processes.

At this point it is useful to review the information processing model for a theoretical perspective on these concerns. As has been previously discussed information processing theory emphasises the limited capacity of the working memory as a
significant constraint in human problem solving. The long term memory, by contrast, appears to have an almost unlimited capacity for information storage. Information held in the working memory is available to the subject directly, whereas information held in the long term memory is only available if it is accessed and brought into the working memory. The small number of items in the working memory act as "keys" to unlock the relevant store of knowledge in long term memory. Figure 2.1 shows the relationship between working and long term memory.
The basis for expertise in a particular knowledge domain will be discussed fully in chapter four. However, it is important to make the point that experts access relevant information from long term memory almost instantaneously. The basis for expertise is the ability to organise information in long term memory so that it is easily retrieved when the relevant “key” is present in the working memory. However, Ericsson and Simon (1993) argue that retrieval from long term memory may still require some problem solving. A single stimulus may not, in itself, define what memory contents are required from long term memory. They suggest, therefore, that reports from long term memory may not be “complete” as we cannot be sure that all relevant items have been retrieved. Only the information unlocked by the cues held in working memory will be accessed.

Implicit to this position is the idea that information can only be retrieved from long term memory if it has been stored there previously. For this to occur information must have been heeded in the working memory for a sufficient period for storage to
take place. As has been suggested above the way in which information is stored or indexed is critical to its future retrieval. This was clearly demonstrated by Woodworth (1915) when he presented subjects with a list of forty words with the instruction to learn them in pairs so that they could respond with the second word when given the first word of the pair. He then tested subjects on their ability to respond with the first item of the pair when given the second item of the previous pair as the cue. Subjects succeeded is only 7% of the trials.

Recognition is explained as a situation in which the stimulus is some set of the characteristics of the item retrieved from long term memory. The process of retrieval appears to be almost instant and the subject cannot access the internal steps of the recognition process itself, in other words how they recognised something. Ericsson and Simon (1993) suggest that for recognition to occur those cues which were present at the time the information was stored must be available for retrieval to take place.

However, subjects often have to retrieve information that cannot be accessed directly. They do this by actively searching for retrieval cues and actively evaluating the information retrieved from long term memory. Thus the ability to respond to the requirement to access information in long term memory is dependent not only on information being stored there but on whether the presenting cues are adequate for its retrieval. When appropriate cues are available immediate recognition is triggered. When this is not the case the cueing stimulus may enable a successful search to be made for the information using heuristics which are procedures for searching for solutions akin to rules of thumb (Ericsson and Simon 1993).
How does this relate to the use of verbal reports? In cases of recognition only the input (the presenting stimulus) and the output (the information retrieved from long term memory) can be reported as the intervening processes are not available to the subject. Where the presenting stimulus is inadequate for direct recognition, and a heuristic search and other problem solving strategies are required, the products of these processes can also be reported. Thus when retrieval involves intermediate search steps the subject can report the items held successively in working memory as the basis for their responses. Ericsson and Simon (1993) therefore contend that verbal reports are based on information currently held in working memory, or information retrievable from long term memory that was previously held in working memory.

2.1.4 Retrospective Reports

Retrospection involves a subject completing a problem solving task and then reporting afterwards on the thought processes used. Various criticisms have been levelled at this approach. Firstly it is constrained by the limitations of the subjects’ memory and thus their ability to accurately recall their thought processes during the problem solving task. Another difficulty is that subjects may not be explicitly aware of their thought processes. Possibly as a result of these two factors they may tend to present their thought processes as more coherent than they actually were. Knowledge of the solution to the problem may lead them to inaccurately reconstruct events in a different way.

The issue of “completeness” of verbal reporting is of particular concern in the case of retrospective reports. Information processing theory postulates that cognitive
processes leave a subset of information heeded in long term memory as a "retrievable trace of connected episodic memory". (Ericsson and Simon 1993). Retrospective reporting requires the subject to retrieve these episodic memories and verbalise their contents. One of the difficulties with this approach is the way it has commonly been used. Frequently subjects are asked to give a retrospective account of their actual cognitive processes during a problem solving task with questions such as "How did you do these problems?" Information Processing Theory postulates that for information to be stored in memory, and therefore reported, it must have been heeded initially. For subjects to report on their cognitive processes retrospectively they would have had to generate and store this kind of description whilst completing the problem solving task. Ericsson and Simon (1994) point out that there is no evidence to suggest that individuals generally do generate such information.

The hypothesis that is at the core of the Information Processing Model is that the information heeded during the performance of a task is the information that is reportable; and the information that is reported is information that is heeded. Therefore subjects can only be asked to report what they have heeded during the task. The approach used to elicit retrospective verbal reports is therefore critical. Lewin (1918) instructed subjects to start their report with "I first thought of ..." This helped to emphasis that the report task was one of recalling distinct thought episodes. Another approach, used by Crutcher (1990, 1992), is to give the subject "warm-up" tasks. He gave subjects two types of mental additions to calculate. The first used single digits e.g. 2+4 and the second two digits e.g. 45+38. The first type of addition involved direct retrieval whilst the second required some intermediate processing. Subjects were given a sequence of these two addition tasks with a reminder to recall
their thoughts or the absence of them (direct retrieval) until their verbal reports conformed to the instructions. Ericsson and Simon (1994) also identify the need to emphasise the importance of the problem solving task. They suggest that subjects should be instructed and reminded to focus on the task and retrieve information for the retrospective report only on completion of each trial. Requesting information on only a fraction of all trials appears to reaffirm the priority of the real task.

In conclusion, subjects can report on tasks retrospectively provided they are simply asked to report that which they have heeded as part of the problem solving task. The gaps that are claimed to be in retrospective reports are attributable to memory failures or confusions, particularly when the subject is asked to give a general report rather then report recent specific memories of particular episodes. When subjects are unable to retrieve information that has been requested from long term memory, they may reason about the situation and report the results of their inferences instead of memories.

The overview of the criticisms of verbal reports has emphasised the importance of research design for the elicitation of both concurrent and retrospective reports as a means of increasing their validity. It is useful to look at the approach taken to process tracing in the field of clinical decision making and examine how the methodological issues identified here have been addressed.
2.2 PROCESS TRACING IN CLINICAL DECISION MAKING

The purpose of studies of clinical decision making has largely been to describe how clinicians respond to clinical problems and relate this to our theoretical understanding of human problem solving. The advantages of the concurrent think aloud approach are recognised but there are obvious difficulties to applying this approach in the clinical setting.

As a result investigators sought to simulate the clinical situation and assess the performance of clinicians in this environment.

Rimoldi (1955, 1961) was one of the first to describe the use of simulations to analyse "the process of thinking". He asked subjects to solve a given problem by asking whatever questions they thought necessary. The questions subjects asked and the order in which they were asked were recorded so that a sequence which indicated the successive steps followed in the solution of the problem could be obtained. Rimoldi (1961) suggested that the presentation of the problem could be standardised by deciding in advance the number and type of questions that might be asked by subjects and the type of information provided in response. He also advocated the inclusion of less relevant questions. Subjects could then be instructed to select those questions which they think will lead most directly to a solution of the problem. Rimoldi (1995) applied this approach in the field of medicine by giving subjects the type of information about a patient that they would usually have available from the medical notes on admission, the patient's complaints and other aspects of his clinical history. His methodology consisted of arranging removable cards in flat pockets on a display folder. At the top of the numbered cards (referred to as items) were the questions that
the subject may ask and on the reverse side were the answers. For example the question may be: Have you been feverish? The answer might be: Yes. Yesterday afternoon had a temperature of 38c. For a question like: Chest X-rays? The answer might be: Both lung fields normal. The order in which the various items of information were sought was recorded.

Rimoldi (1955) analysed the results by identifying for each item:

- the utility index – it’s degree of usefulness.
- The median value, which part of the problem solving process were the items chosen in,
- The dispersion of the items, in other words whether some items are consistently sought at the beginning or the end or can be selected at any point during the test.

He discusses possible methods for scoring the test which include an agreement score, a comparison between subjects’ sequence of items with the average order in which items are selected by a group of experts – the “optimal sequence”. A utility score for each subject is the sum of the utility indices for all the cards he has chosen divided by the number of items. The number of items selected can also be scored for each subject. A score based on the solution to the problem can also be derived. It was recognised that members of the expert group may give different solutions to the same problem and that a system of differential weights could be developed. Rimoldi (1955) also proposed a qualitative analysis of the item sequences in order to infer what information was crucial to the solution of the problem, what hypotheses were made by the subject and how he proceeded in order to confirm or refute them. This
information was obtained by analysing the spontaneous verbalisation of the subjects, by asking certain questions, and by studying which items are selected and when.

Given current thinking about human problem solving there are a number of concerns about the approach Rimoldi (1955) describes. The first relates to the predetermination of questions a subject can select, in that this might not reflect the range of questions a subject would otherwise ask and thus may inhibit his natural problem solving approach. There is also the possibility that the presence of other questions may suggest a line of inquiry to the subject and distract him from the course he would otherwise pursue. To a large extent Rimoldi’s (1955) approach to analysis may be said to be aimed at establishing the “correctness” of the subjects’ approach to the task as measured against the performance of experts. His proposals for qualitative analysis represent the best approach to understanding the process of reasoning an individual goes through in order to reach a solution to a problem.

However, Rimoldi’s (1955, 1961) work was important for raising the issues related to studying higher mental processes. There was considerable interest shown in his early work particularly by medical educators who saw its potential benefits for teaching and evaluating medical students. His approach represented an improvement over traditional true-false or multiple choice type tests. His early findings support the current view that each one of us has a highly individualised knowledge store that is continually being refined and updated. He noted that subjects who reach the same diagnosis did so by following different processes. These differences were found particularly in the part of the test which related to interviewing “the patient”. He noted that the interview phase best distinguished between clinicians with differing
levels of experience, with junior students varying widely in their approach, senior students showing more uniformity and more experienced physicians adopting a more discriminative approach. This finding provides further evidence to support the view that expert problem solving is rapid and highly specific as a result of rapid retrieval of a highly organised body of knowledge.

Nevertheless, Rimoldi (1961) does note that the test he devised is not identical to the clinical situation "which can only be approximated by a testing device". This issue of fidelity or ecological validity gained prominence in the methodological debate as research in this area developed.

Because of the advantages of written simulations in terms of experimental control further work was done in this area. McGuire (1963a,b; 1965a,b) developed written Patient Management Problems (PMP) to evaluate the physician's ability to elicit information from a patient, interpret abnormal findings, select and interpret laboratory investigations and synthesise all the data obtained to arrive at a diagnosis and management plan. The Patient Management Problem consists of the simulation of a actual clinical situation as it might be presented to a physician. A series of possible responses by the physician is listed and he selects the one he judges to be most appropriate in the particular situation described and erases an opaque overlay beside his choice. This reveals information which is either purely descriptive or indicates how the clinical situation has been altered by his action. For example the information relating to "Barium enema" may be "no abnormality detected". Following selection of a rectal examination on a patient with an acute myocardial infarction he may be told that the patient collapses immediately with ventricular tachycardia and acute
heart failure. Depending on his choice of response the physician may be referred to other sections of the test booklet. If a subject elects to investigate the patient immediately he turns to the section which lists a range of possible investigations. If he wishes to pursue the patient’s history he turns to the section which offers a list of potentially relevant questions which could be asked of the “patient”. The physician’s clinical competence is assessed by the quantity and quality of erasures he makes. Each selection is scored by a group of experts as having a high positive score where the choice is clearly indicated and of particular importance, a low positive score where the choice is indicated but not of special relevance, a zero score where the choice is routine and unlikely to be of value to this patient, a low negative score where the choice is not indicated but is not costly or harmful to the patient, a high negative score where the choice is clearly contra indicated in this patient.

McCarthy (1967) indicated a number of problems associated with the use of PMP technique. The preparation of patient management problems requires considerable time and effort and this contributes to making the test more expensive than ordinary multiple choice testing. There are difficulties in scoring subjects who erase a whole section of choices indiscriminately. McCarthy (1967) suggests that as students are taught to do a full history it may be unfair to expect a more efficient approach in a test situation. On a practical note subjects may accidentally erase choices. Finally he acknowledges that, as with Rimoldi’s test, the presence of lists of potentially relevant choices could provide a cueing effect which would not be present in the clinical situation.
In an effort to obtain greater understanding of the clinical judgement and problem solving processes of clinician Butcher and Scofield (1984) used the Written Treatment Planning Simulation (WTPS) (Scofield 1981) and tape recorded verbal protocols of 15 counsellors thinking aloud to identify the cognitive processes involved in a mental health treatment planning task. The WTPS consists of sealed reports pertaining to the patient organised in a booklet format. The subject is instructed to review a master list of all the reports available and select one to read first. The subject continues with this process until he is in a position to write a case summary and a treatment plan. Butcher and Scofield (1984) report that the subject was asked to think aloud while selecting and reviewing reports in response to the following questions: Why are you selecting that report now? What seems important to you as you read the report? What had you learned about the case from this report? What further information do you want as a result of this report?

In the light of current knowledge about the potential effects of cueing by providing the subject with a list of options, and the potentially constraining effects of setting specific instructions in relation to thinking aloud, the approach used by Butcher and Scofield (1984) could be criticised. However, using the think aloud technique in addition to a written test does allow the research to validate inferences made from the results of the written test alone.

Within nursing a number of investigators also chose to use simulations to measure the clinical decision making of nurses. Dincher and Stidger (1976) describe a study to develop an instrument to measure nurses’ ability to make clinical nursing judgements. The instrument they developed consisted of a verbal description of the patient and
presentation of the information given at the shift handover. The subject was then asked to select from a number of enquiries or actions such as observe the patient, read the kardex, or check vital signs. In response to these actions and enquiries the subject was directed to further information about the patient and proceeded through the task in this manner. Choices made by the subjects were weighted according to their relevance and three scores were obtained for each subject: a total score, the total number of positive points minus the negative points, a proficiency index, the percentage of agreement between subjects and experts in selecting beneficial and avoiding harmful or negatively scored choices, an efficiency index, the percentage of helpful selections. Again the instrument was designed for use in the educational setting rather than as a research tool.

Further work was undertaken in an attempt to develop written simulations for teaching and evaluating clinical problem solving skills within nursing (Holzemer et al 1981, Farrand et al 1982, Holzemer 1986). Simulations were also used by a number of researchers to examine nurses' clinical reasoning within a research context. Grobe et al (1991) used simulations to examine the reasoning used by experienced nurses in planning patient care. Corcoran (1986) used three written cases which represented three levels of complexity for decision making in relation to developing a plan for effective pain control. The levels of complexity of the planning task was determined by the number of sources of pain presented by the patient, the interrelatedness of the sources of pain and the extent to which hospice protocols could be applied to the case. The case descriptions were developed by the investigator and the medical consultant using actual patient histories. Subjects were asked to read the case description aloud, develop a drug administration plan, and write the plan. They were instructed to think
aloud whilst performing these three tasks and their verbalisations were recorded and analysed.

Westfall et al (1986) and Tanner et al (1987) who reported on different aspects of a study in which the diagnostic reasoning components of hypothesis activation, information gathering and hypothesis evaluation were explored, used a broader range of clinical material to develop nine different patient situations. In order to develop their simulations the investigators asked practising nurses to describe situations in which a nursing decision had affected patient well being. Thus each simulation was based on an actual clinical situation. The simulations represented diverse medical and nursing diagnoses commonly encountered by nurses and task characteristics which were thought to influence diagnostic reasoning strategies such as the complexity of the diagnosis and the complexity of cues. The data made available to subjects during the experiment were largely drawn from actual patient records. Each simulation consisted of a verbal handover report, a short video-tape of a patient showing signs and symptoms suggestive of several problems and a complete set of pre-hospital and current health data used for responding to subjects’ requests for additional information. After hearing the report and viewing the video-tape each subject was instructed to ask for additional information as they would in clinical practice. As they did so they were instructed to think aloud, verbalising their problem solving processes. These verbalisations were tape recorded and subsequently analysed.

In summary, section 2.2 has described the efforts of researchers to apply the process tracing approach in studies of clinical decision making in medicine and nursing. This effort has largely focused on developing tools, in the form of simulated clinical
activities, to replicate the clinical environment. The next section describes an increasing concern for ecological validity and the way in which this has influenced the application of the process tracing approach.

2.3 ECOLOGICAL VALIDITY

Clearly there are methodological advantages to using simulations to measure subjects clinical reasoning. It allows the investigator to approximate the clinical environment whilst controlling for variables that would be present in the real life situation. The advantages include the predetermination and preselection of the task to be presented to subjects, standardisation in the way the task is presented and compression of real time (Fonteyn et al 1993). However, there are also disadvantage to this approach the main one relating to ecological validity. Lamond et al (1995) describe ecological validity in this context as the extent to which the task and context adequately reflect reality. As Fonteyn et al (1993) point out simulations are inevitably “incomplete representations of actual client situations”. The assertion that the output of think aloud studies are adequate representations of the subjects thought processes is therefore based on the assumption that the simulation adequately represents reality (Lamond et al 1995). It is relatively straightforward to establish the content validity of case simulations through the use of expert panels. However, this represents only one aspect of the task environment which the investigators are seeking to replicate. Rock et al (1987) proposed a framework for considering clinical judgement ecology which consists of four interactive components: the characteristics of the subject, the information processing activity which the subject goes through, the criterial task presented to the subject and the nature of the clinical materials that provide the basis for judgements. Lamond et al (1995) suggest that this last category is of particular
importance in the design of simulation. They found that during assessment tasks
nurses utilise verbal information twice as much as any other type of information so
that observation, their own knowledge and written information are used less often
with the latter being used only 8% of the time. This finding is similar to that of
Corcoran-Perry and Graves (1990) who found that nurses utilised verbal information
as frequently as written information. Within their study they confined verbal sources
to interpersonal contacts with other nurses and staff members. Had interpersonal
contact with patients and their relatives been included in the analysis it is possible to
hypothesise that verbal sources of information would have been the major source of
information as in Lamond et al’s (1995) study. On the basis of this finding Lamond et
al (1995) suggest that it is inappropriate to design simulations of nursing assessment
tasks which rely on written material as the sole source of information available to
subjects.

Two groups of studies into clinical decision making, the Michigan and McMaster
studies sought to improve the validity or fidelity of simulations by replicating the
clinical situation even more closely through the use of trained actors who played the
role of patients. Elstein et al (1978), working in Michigan, provided actors with a
comprehensive case history and made available to them far more data than would
normally be requested during a clinical assessment. The actors were thus able to
present a convincing performance. There was no fixed script for their interaction with
the physician subjects apart from the opening statement of the chief complaint.
Physicians undertook a clinical interview as they would in practice and when they
were ready to begin the physical examination the actor was replaced with an assistant
acting as a "data bank". The data bank contained all the information from the
physical examination that the subject could possibly want but this was only made available in response to the subject's questions. The physicians were asked to think aloud whenever possible and particularly when natural breaks occurred to provide an ongoing record of their reasoning. The investigators noted that many subjects were quite adept at this as it reflected their usual behaviour on ward rounds or when reviewing cases with students. Most of the subjects reported that the simulations were convincing and provided a satisfactory approximation of the feel of a real case.

Elstein et al (1972) suggested that simulated cases provided an opportunity to observe the data-gathering and reasoning processes of physicians in moderately controlled environments so that the behaviour of different subjects could be compared. Standardisation is introduced by pre-designing the problems with which the physician subjects are presented. Thus, the investigators argue, an appropriate degree of experimental control is achieved without creating a setting so far removed from clinical practice that it would jeopardise generalisations to actual clinical settings. As there were no constraints or special instructions imposed on the candidates the approach of Elstein et al (1972) would have met the criteria identified by Ericsson and Simon (1973) for yielding valid data on the subjects' thinking.

In summary, concern for ecological validity led to the development of increasingly sophisticated simulations which better replicated the clinical setting.
2.4 STIMULATED RECALL

Elstein et al (1972) backed up the think aloud part of the experiment with a further "stimulated recall" session. Immediately after the clinical work up had been completed a video tape of the physician-patient encounter was replayed to the subject. A research assistant acted as an interrogator encouraging the physician to use the videotape to stimulate his memory and to relate what his thoughts had been throughout the clinical assessment process. This represents a further attempt to elicit the thoughts, feelings and associations which were going through the mind of the subject during the clinical problem solving process. The simulated recall session was audio-taped for subsequent analysis.

Elstein et al (1978) considered the potential problem of retrospective distortion, in other words, the extent to which a subject’s recall of his thought processes when reviewing the videotape of the clinical encounter may have been distorted by his knowledge of the data subsequently available and the final solution to the problem. They therefore developed principles for identifying retrospective distortion where it had occurred. The basic principles were that each formulation of thought must be consistent with the data base existing at the time and that stimulated recall accounts must be consistent with think aloud descriptions of reasoning processes. Where retrospective distortion was identified greater credence was given to data obtained concurrently.

However, the investigators found that the vast majority of stimulated recall protocols were consistent with data obtained concurrently. They also noted that the subject’s account of his strategy was usually consistent with his behaviour.
The McMaster studies were carried out by Barrows et al (1982) using a similar approach to Elstein et al (1972). The main variance in the methodology was that their subject were not asked to think aloud during the clinical encounter as the authors considered this activity intruded into their continuity of thought and behaviour (although the work described earlier by Ericsson and Simon (1993) would suggest that this was not a valid assumption). Immediately following the clinical work up they were asked to prepare a medical record of the encounter in their usual way. Having completed this subjects reviewed the videotape of their clinical encounter with one of the investigators. The subject was asked to describe his thinking at the point observed on the videotape to avoid any bias produced by information that was gathered later in the encounter. The transcript of this recall session was sent to the physician within 48 hours with a request to record on it which of his hypotheses were tested by each question posed and each part of the physical examination. He was also asked to estimate the connection between signs and symptoms elicited from the patient and the hypotheses he had generated during the encounter. Subjects were further asked to distinguish between routine and non-routine aspects of their questioning and physical examination. Non-routine actions were those used to establish, rank or eliminate a particular diagnosis. Routine actions were those he would always use with such presenting problems regardless of any diagnostic hypothesis.

Gale (1980) working in the UK also used a similar approach to the Michigan and McMaster’s studies. The main difference was their use of real patients who were recruited on the basis that they were an in-patient on a general medical ward on the day and were able to give a comprehensive history. The rationale for this was to
provide a high fidelity research instrument on the basis that the diagnostic thinking process only occurs under conditions where a diagnosis must be made. This is useful because Ritchey et al (1984) suggest that “there is a qualitative difference in the way people respond to real life and hypothetical situations”. This view is supported by the findings of Leaper et al (1973) who reported that there was a considerable difference between real life and simulated situations. A further problem with simulating the problem solving task is the enormous amount of time required to develop and validate the simulations. Kassirer et al (1982) suggest that “the degree of correspondence between the experimental setting and an actual clinical encounter, the fidelity, is one important dimension in the design of these experiments,” while Rimoldi (1961) who developed a test of diagnostic skill, commented that “the test is not identical to the clinical situation which can only be approximated by a testing device”. The design of Gale’s (1980) study was aimed at maximising the ecological validity of the experimental setting. Subjects were not required to think aloud during the work up which was video-taped. The clinical encounter took place in a side ward with only the patient and the physician present, the investigator viewing the encounter simultaneously via a monitor screen. When the session was over the patient returned to their ward and the subject joined the investigator for the stimulated recall session. The recall session was audio-taped and a number of criteria were used to determine when the videotape should be stopped to gather an account of the subject’s thinking processes:

1. Replay periods should not be so short that the context is obscured.
2. Each replay period should have an information load appropriate to the nature of that information so that as more routine information is elicited the replay period may increase.

3. The replay period should not be so long that the subject becomes a passive viewer rather than an active interpreter.

All the studies described above rely heavily on the use of stimulated recall and it is therefore useful to review here the methodological issues relating to this approach. Gale (1980) argues that gathering accounts of subjects' thinking processes, following a problem solving task, using stimulated recall increases the reliability and validity of the data. The characteristics of this approach which contribute to increased reliability and validity are the standardised implementation, circumscribed content, and external agencies for guidance and stimulating recall (non-directive questioning and videotape playback). Gale (1980) also identified as an advantage the fact that the approach does not interfere with the subject's problem solving as it occurs. As described earlier Ericsson and Simon (1993) would argue that concurrent think aloud does not necessarily distort the subject's reasoning processes. However, it should be noted that Gale's (1980) study involved the use of real patients which would also have precluded the use of concurrent think aloud as method of data collection.

Stimulated recall was first used by Bloom (1953) as a methodological approach to tracing students' thoughts during lectures and discussions. He suggested that "a subject may be enabled to relive an original situation with vividness and accuracy if he is presented with a large number of cues or stimuli which occurred in the original situation". Kagan et al (1967) applied the approach in the field of counselling where
it is difficult for a subject to think aloud whilst interacting with another person in a normal manner. They noted that “if we could give a subject enough clues and cues to help him relive the experience, we could explore in depth at a later time various points in the interaction, the thoughts, feelings, changes in thoughts and feelings, and the meaning of various gestures and expressions”.

Calderhead (1981) reviewed the use of stimulated recall, its advantages and disadvantages, and concluded that although questions of validity could not be completely resolved the technique presented a systematic approach for collecting data concerning teachers’ thoughts and decision making.

The main concern in relation to stimulated recall continues to be of that of retrospective distortion. In other words, it cannot be established the extent to which a subject’s account of his reasoning processes has been distorted by his knowledge of data subsequently available. There are two arguments to counteract this concern. Firstly the material used to stimulate recall itself provides a means for checking the plausibility of the subject’s account. The principles for identifying and handling retrospective distortion described by Elstein et al (1978) can then be applied. Secondly Gale (1980) argues that the cognitive complexity and demand on working and long term memory make it improbable that subjects could sustain a retrospective rationalisation or distortion. This view is supported by the findings of Elstein et al (1978), described earlier, that the subject’s account of his strategy was usually consistent with his behaviour.
2.5 NATURALISTIC DECISION MAKING

Gale's (1980) departure from the use of simulated patients and her desire to replicate the clinical situation as accurately as possible reflects a growing concern with the issue of ecological validity discussed earlier. Cannon-Bowers et al (1996) suggest that recently a paradigm shift has occurred in the research of human decision making. Researchers are now more interested in studying decision making as it occurs in the real world under naturalistic conditions and the naturalistic decision making (NDM) movement has grown. The movement was born out of dissatisfaction with classical decision making research which was seen as focusing on sterile, contrived decision making situations with results that were of little consequence to real world decision makers. Orassanu and Connolly (1993) noted that it was not feasible to apply classical decision making research analyses to many real life situations because it fails to account for the decision maker's experience, task complexity, and the demands of the naturalistic environment. Rather they sought to shift the focus of research onto "decisions that are embedded in larger dynamic tasks, made by knowledgeable and experienced decision makers." The emphasis is on how decisions are made in complex, real world environments. Orassanu and Connolly (1993) identified eight factors that characterise decision making in naturalistic environments:

- ill structured problems
- uncertain, dynamic environments
- shifting, ill defined or competing goals
- multiple event feedback loops
- time constraints
- high stakes
- multiple players
• organisational norms and goals that must be balanced against the decision maker's personal choice.

Some or all of these characteristics may be present for a decision to be considered naturalistic. From a review of these characteristics it can be argued strongly that clinical decision making is naturalistic. Clinical decisions are by their nature ill-structured problems occurring in dynamic environments in which the patients' condition is changing (sometimes rapidly). There can also be lack of clarity over goals where clinical priorities are competing. Equally the clinician receives feedback from multiple events such as laboratory results, an evolving patient history, or the patient's response to intervention during the clinical problem solving task. The time constraints will depend on the acuity of the situation which could also affect how high the stakes are. However, it is clear that in the clinical setting decision making frequently occurs in an environment where there is a need for rapid decision making and the loss of life is a possible consequence of flawed decision making. Although most clinical situations involve the interaction of a single clinician with a patient there is a growing pattern of team working in health care across the spectrum. This would include the "crash" team responding to a cardiac arrest and the multi-disciplinary team responsible for the effective rehabilitation of a patient following a stroke. All clinicians operate within organisational and professional boundaries where protocols and procedures govern clinical practice. However, there can be occasions where clinicians must consciously elect to deviate from normal practice. Having concluded that clinical decision making is an example of naturalistic decision making it is useful to understand the contribution that the NDM movement has made to decision making.
research and in particular to developing methodological approaches to the study of decision making.

Klein and Woods (1993) have identified three areas in which NDM has added to the understanding of decision making. It has focussed on how decision makers bring their expertise to bear in the decision making situation. The issue of expertise will be discussed in more depth later in the thesis. Secondly, NDM broadens the focus of decision making research to a consideration of the "larger processes of situation assessment". Finally the models developed within NDM suggest that different cognitive strategies are used when the decision is viewed as temporally evolving event rather than as a static event. They also identify that action and perception are crucial aspects of cognition, that human resource limitations are an important factor in decision making as previously discussed, and that human decision making competence rather than dysfunction should be emphasised.

With regard to methodological issues Cannon-Bowers et al (1996) note that NDM researchers have generally rejected the notion of laboratory studies in favour of the field. The authors reject this position as too extreme but recognise the importance of the balance between the control of variables and the need to overcome artificiality in experimental settings. In relation to clinical decision making concern for ecological validity had led to a shift away from the use of simulations and more recent studies have been conducted using real patients in the clinical setting (Fonteyn et al 1993, Watson 1994 and Hagedorn 1996).
At the beginning of this chapter three key criticisms of the use of verbal reports as data were identified and one of these related to the analysis of data elicited through verbal reports. This section discusses approaches to data analysis and issues of reliability and validity.

Verbal reports are analysed by the process of content analysis defined by Holsti (1968) as “any technique for making inferences by objectively and systematically identifying specified characteristics of the message”. The approach involves analysing verbal protocols in order to assign segments to different categories. Weber (1985) suggests that content analysis is a research methodology that can be used to make valid inferences from text, using a set of procedures.

He describes the steps in creating and testing a coding scheme:

- Define the recording units (word, word sense, sentence)
- Define the categories
- Test the coding on a sample text
- Assess the accuracy and reliability
- Revise the coding rules
- Re-test
- Code all the data
- Assess achieved reliability

The definition of categories will depend to a large extent on the purpose of the research, whether it is theory generating or theory testing. Carney (1972) suggests
that this approach can be used to generate inferences and that a content analysis of a set of data establishes a body of knowledge. Content analysis can also be used for theory testing, in other words to ascertain how accurately the theory depicts the phenomena under study and their relationships. The theoretical hypotheses provide the basis for developing the categories to be used in the analysis of the data. In the field of human problem solving content analysis has largely been used to compare the cognitive behaviour of subjects to the theoretical understanding of information processing and problem solving. Indeed Montgomery and Svenson (1989) make the point that verbal protocols contain a lot about the information processed but very little or nothing about how it is processed. To interpret the data it is important to have a good underpinning theoretical framework or model in order to be able to understand the data in terms of cognitive process. They suggest that it is rare that verbal protocols themselves provide the theory for their understanding. Rather the amount of data elicited can make it difficult to find a structure for the understanding or explanation of the process that yielded the data in the first place. However before reviewing examples of how this approach has been applied it is important to address the issues associated with reliability and validity of the data and its analysis.

In addition to the concern about the use of verbal reports previously identified, Ericsson and Simon (1984) identified three further concerns which must be addressed. The first of these is that verbal report are "epiphenomenal," that is that they have been produced independently of the cognitive processes under study. However, Kassirer et al (1982) argue that "it is unlikely that thinking without speaking is entirely different from thinking while speaking, and presumably the latter helps us understand the former." A second objection is that verbal reports are idiosyncratic in
that they reflect the unique experience of the individual and therefore cannot be used to draw generalisable conclusions or develop theory. Ericsson and Simon (1984) suggest that individual differences do indeed exist and that the methodological approach should not aim to conceal these differences. The third criticism relates to the difficulty of developing an objective and sound coding system for the analysis of data. This issue will be discussed later in the chapter.

In order to refute the epiphenomenality argument Ericsson and Simon (1984) suggest that there are three criteria which data should meet if they are to be used to infer underlying cognitive processes. The first is the relevance criterion and to meet this verbalisations must be relevant to the task. The second is the consistency criterion, to meet this the data should be logically consistent with the data that immediately precede them. For the third criterion, the memory criterion, Ericsson and Simon (1984) suggest that a subset of the information heeded during the problem solving task will be remembered and available for subsequent retrieval. Thus verbal protocols can be reviewed to assess whether they meet these criteria and therefore provide a basis for making inferences about the subjects' cognitive processes.

2.6.1 The analysis of verbal protocols in studies of clinical decision making

It is useful to consider here how the verbal protocols produced in studies of clinical decision making have been analysed. Elstein et al (1978) identified four principles which guided the development of a scoring system for their data: objectivity and reliability - independent judges ought to reach 85% agreement on the specific categories to which data is assigned; task relevance - the method should reflect the
critical and relevant characteristics of the type of cognitive functioning under study; theoretical relevance - the scoring system should describe the physicians' performance in a way that is medically relevant but enables it to be related to broader theories of cognitive functioning and problem solving; discriminant validity - the scores achieved should distinguish between different levels of competence at performing the problem solving task.

Having identified these principles Elstein et al considered what the units of analysis might be within the data. Their main rationale for using a high fidelity simulation was that the units of analysis for medical problem solving were largely unknown. Through analysis of the simulation data and developing and refining operational definitions of concepts they identified the three fundamental units of protocol analysis as being information search units, cues and hypotheses. They described information search units as any statement or act that either seeks information from the patient, instructs a patient concerning a procedure, or establishes rapport between the physician and the patient. Eight content categories were developed within this unit for analysis: history of present illness, personal and social history, previous medical history, family history, physical examination, laboratory, instructions and rapport. History of present illness was further subdivided into effects on the patient, time variables, patient's view of precipitant signs or symptoms, modifying factors, contacts and other. It is worth reflecting whether the inclusion of instructions to patients and establishing rapport are best described as information search units. Instructions to patients are largely to enable the performance of some diagnostic procedure and do not in themselves yield information. Similarly whilst it is important to establish rapport with the patient to facilitate the clinical interview this type of discourse in
itself is not aimed at eliciting clinically relevant information. Although this seems a minor point it is relevant because the investigators went on to count the number of information search units in the clinical work up and the inclusion of these aspects may be said to have inflated this count.

Elstein et al (1978) were also keen to establish the extent to which the search for information was directed by a hypothesis being entertained by the physician or was simply routine. They were unable to reliably discriminate between routine and hypothesis directed data searches but felt that this distinction continued to make intuitive sense to them and the physicians they discussed the problem with. This issue was returned to by Barrows et al (1982) and Gale (1980, 1984).

A list of potential cues for each case was compiled and numbered so that the consequence of cue acquisition could be derived from the work up. Diagnostic hypotheses were identified through analysis of the protocols from the think aloud and stimulated recall sessions. Thus the hypotheses entertained most frequently in each case were determined. A cue-hypothesis matrix for each case was developed which showed the weighting given by an expert of the relevance of each cue (from a score of −3 to +3) to each hypothesis. This provided a benchmark for assessing the weights assigned to cues by the physician subjects. A tally sheet or “map” of each subjects’ progress through the clinical work up was drawn up. This showed the point at which each hypothesis were generated, the points at which cues acquired and when they were applied to hypotheses.
Based on this approach to the analysis Elstein et al derived a number of variables. They looked at total information search units and a number of variables relating to hypothesis generation such as, point of generation of first hypothesis, number of hypotheses active a quarter of the way through the work up, number of hypotheses active halfway through the work up, total number of hypotheses generated, and number of hypotheses retained. These variables were derived following the results of pilot work which suggested that specific hypotheses were generated early in the diagnostic process. Further information was sought on the rate of turnover of hypotheses and the progress of convergence on a single solution. A further set of variables were developed which related to cue acquisition namely the number of cues acquired, the percentage of cues acquired, the number of critical findings acquired, and the percentage of critical findings acquired. By examining these variables the authors sought to establish the thoroughness of the data collection and the extent to which it focused on high yield data. The final set of variables related to the efficiency and accuracy of individuals' performance of the clinical task. Efficiency was described in terms of the percentage of critical findings elicited by the subject that are weighted strongly positive for one of the hypotheses under consideration. It is a measure of the clinicians own hypothesis evaluation activity. Accuracy of interpretation was measured by comparing the subject's interpretation of the data with that offered by the cue-hypothesis matrix. The investigators also sought to establish the modal interpretative error on the basis that the specific type of error committed in relation to cue interpretation would distinguish the less skilful diagnosticians from the more skilful. Finally Elstein et al (1978) developed variables in relation to accuracy of formulation and accuracy of outcome. These were aimed at
identifying whether the subject generated the accurate solution hypothesis and whether this hypothesis was retained on conclusion of the task.

Thus Elstein et al’s (1978) approach to the analysis of their data was based on describing a model of diagnostic reasoning and assessing frequency, comprehensiveness and accuracy of activities within this model. They sought to explain the behaviour of physicians in terms of cognitive theory and at the same time evaluate their performance on a number of dimensions. The main weaknesses of their approach, as they identify, are the reliance on the cue-hypothesis matrix as a basis for comparison with subjects’ performance when this itself was derived from the input of only one or two experts and the general difficulties relating to the use of verbal data that have been discussed previously. As a result of their work they proposed a model of diagnostic reasoning which consisted of four main activities: cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation.

Barrows et al (1982) adopted a similar approach to scoring the data they derived from verbal protocols of a clinical encounter and stimulated recall session. However, they sent the complete transcripts to subjects within 48 hours of the problem solving task requesting them to record which of their hypotheses was tested by each question or physical examination. They were asked to estimate the connection between signs and symptoms elicited and hypotheses generated, scoring them +2, highly related, to –2, highly unrelated. Subjects were also asked to identify their questions and physical examination as routine or non-routine. In this way the authors sought to overcome the difficulty identified by Elstein et al (1978) of distinguishing between hypothesis driven and routine enquiry.
Like Elstein et al (1978) Barrow et al (1982) attempted to evaluate the performance of physicians in order to assess what variables in the physician’s reasoning process affect the quality of outcome in terms of diagnostic and therapeutic decisions. To do this they developed aggregate scores for the physician’s diagnostic hypothesis during the encounter, his final diagnosis and his management plans. Essentially their approach was to confirm the hypothetico-deductive model of diagnostic reasoning and identify aspects of physician performances within this model which contributed to diagnostic success.

In defining categories for content analysis Gale (1980) adopted a hypothesis testing approach and used a cyclical, repetitive process to develop categories which would adequately test her research hypotheses. This is represented by the figure shown below:
By following this process of going from the research hypothesis to the transcripts and back again fourteen possible separate thinking processes were identified. The reliability and validity of both the processes and the raters were established by repeated ratings and inter-rater reliability studies. For each category Gale (1980) developed a category definition and a set of indicators based on examples from the transcripts. For example:

**Category:** Expecting, searching for or planning to search for specific features (symptoms, signs, etc) of disease or treatment of disease.

**Definition:** Where the subject shows expectation of certain clinical information or considers certain features of disease likely or possible in the patient, given the information already elicited.
Indicators: “If we investigated the patient, I’d imagine we’d find X.”

“I was thinking it might be diagnosis Y, so I went through other things typical of that”.

Appendix 1 lists the categories, their definitions, and indicators for all of the fourteen thinking processes Gale (1980) describes. Her approach was to test hypotheses relating to the thinking processes of clinicians and the impact of education, experience and specialisation on these processes. Gale’s (1980) approach was considered helpful in providing a structure for the analysis of data in the first study reported here. Indeed some of the categories for content analysis were utilised in this study to see whether there was evidence of similar thinking processes by district nurses during the course of a nursing assessment.

SUMMARY

This chapter has reviewed the methodological approaches taken to the study of clinical decision making. The criticisms of verbal reports have been reviewed and the contribution of research design to overcoming these issues has been discussed. A key factor is the nature of the instructions given to subjects and the extent to which these might distort the way in which the problem solving task would normally be approached. A concern about the nature of the task which subjects are asked to complete has also been identified, with investigators placing increasing emphasis on adequately representing the real world situation in the experimental setting and the naturalistic decision movement advocating research in the field setting. The final section of the chapter reviewed the analysis of data elicited from verbal reports and
concluded that data could be scrutinised to ensure that it met key criteria before proceeding to make inferences about the subjects' cognitive processes. The approach of Elstein (1978) and Gale (1980) was reviewed in some detail because it underpinned the approach used in this study. The following chapter is a report of the first study and shows how the methodological issues discussed here have been addressed.
CHAPTER THREE

STUDY ONE: AN INVESTIGATION INTO THE TYPES OF DECISIONS MADE BY DISTRICT NURSES DURING AN ASSESSMENT VISIT AND THE COGNITIVE STRATEGIES THEY USE

3.1 INTRODUCTION

Westfall et al (1986) and Tanner et al (1987) sought to establish whether Elstein’s (1978) model of diagnostic reasoning adequately described the reasoning strategies used by nurses in the course of assessing patients. The first study, described here, broadly took the same approach in seeking evidence of the cognitive processes described by Elstein (1978). Because the study of decision making was still a relatively new area of research in community nursing it was considered helpful to identify the full range of decisions made by District Nurses rather than restricting the focus to diagnostic decisions. The purpose of the study, therefore, was to establish the types of decisions made by District Nurses and develop an understanding of the cognitive strategies they used to identify patient’s nursing problems.

3.1.2 Aims of the study

The aims of the study were therefore defined as follows:

1. To test the hypothesis that in the course of assessing patients and identifying nursing problems District Nurses attend to cues, activate hypotheses and carry out a hypothesis directed data search until a final hypothesis is accepted.
2. To describe decisions, other than the diagnostic decision, that occur during the assessment visit.

3.2 METHODOLOGY

3.2.1 Research Design

This section provides an overview of the key features of the research design and is followed by more detailed discussion of the sample and the procedures used to collect data. In this study a process tracing approach was used to attempt to trace the cognitive strategies used by nurses whilst assessing new patients. Previously it was noted that van Someren et al (1994) described observation as an approach to investigating problem solving, the advantage being that it provides an opportunity to witness the problem solving task in the natural setting. Thus whilst not directly measuring the cognitive processes used, the researcher can observe how subjects approach the task, what information they seek and the order in which they progress, which provides some evidence for the cognitive processes they may be using. Van Someren et al (1994) also note that, in addition to observation by the researcher, where the problem solving task naturally involves dialogues this can be recorded in the field and used as verbal data about the process.

The two methods used to study the clinical decision making during an assessment visit were non-participant observation during the assessment visit, which was also tape recorded, and a stimulated recall session immediately after the visit. The observation allowed the investigator to share visual cues with the subject and subsequently validate their reported responses to those cues. The stimulated recall
session, which was again tape recorded, provided a more direct measure of the nurses
cognitive process which could only be inferred from the visit data. Data, in the form
of verbal protocols, was analysed by content analysis using a coding framework
which was partly predetermined and partly derived from the data itself. Reliability of
the coding framework was determined using inter rater reliability. The measures used
were percentage agreement and Cohen's Kappa (Cohen 1960).

The sample was recruited from a group of nurses who are considered to have
expertise in the area of clinical decision making which was the focus of the study.
The data were collected in the naturalistic setting because this was a new area of
research and the community was considered to be a complex setting which would be
different to simulate. Conducting the study in the field gave an opportunity to capture
this complexity.

The emphasis on ecological validity was aimed at producing rich data and necessarily
limited the number of nurse-patient encounters that could be included in the study in
line with the approach used in similar studies (Carroll and Johnson 1990, Fonteyn et

Prior to each assessment visit a task analysis was completed to identify the
characteristics of the subjects and the clinical information, such as medical notes and
referral information, that was available in advance of the assessment visit.

The key design features are illustrated by figure 3.1 overleaf.
Figure 3.1 Key features of the Research Design

**SAMPLE**
Chosen on the basis of their expertise.

**SETTING**
Naturalistic
Ecological validity

**TASK ANALYSIS**
Characteristics of the subject
Clinical materials available

**METHODS**
Process Tracing
Observation of assessment
Stimulated recall

**DATA**
Verbal protocols:
Assessment visit
Recall session

**DEVELOPING A CODING FRAMEWORK**
Predetermined categories to test the research hypothesis
Categories derived from the themes emerging from the data

**CONTENT ANALYSIS**
Assigning data (verbalisations) to coding categories

**VALIDITY AND RELIABILITY**
Evaluation of data against relevance, consistency and memory criteria.
Subjects' estimation of the similarity of study visits to their usual performance.
Inter rater reliability measured by percentage agreement and Kappa value.

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3.2.2 The sample

The sample was recruited from District Nurses employed by one health authority. The criteria for inclusion were deliberately broad to maximise the potential number of subjects and research visits:

- The nurse had to be a District Nursing Sister/Charge Nurse. This was because the Sister/Charge Nurse has a formal responsibility for assessing patients, deciding whether to admit them to the nursing caseload and determining what nursing care they require. As such they are deemed to have expertise in this area.
- The nurse had to give written consent to being part of the study.
- The patient’s consent had to be obtained prior to commencing the visit.

The nurses were asked to exercise their professional judgement about excluding referrals from the study— for example, referrals for terminal care and patients with HIV. A letter was sent to District Nurses in seven bases inviting them to take part in the study and seven nurses from four bases agreed to take part in the study. One nurse never contacted the investigator, despite reminders, and so only six took part in the study.

All the nurses in the study knew the investigator who was employed in the same health authority. It was considered that this lack of anonymity could be threatening to staff, particularly as the investigator had a management role within the authority, and could introduce an element of bias to the study. However, the investigator guaranteed confidentiality to the individual nurse subjects although this created a potential ethical dilemma in that the investigator may have uncovered examples of poor practice. This
was resolved by stating that generalised feedback would be given to nurse managers if situations of concern arose. In order to assess the impact of the investigator's presence and the tape recording of visits, each subject was asked how typical her behaviour was of her usual practice.

The decision to undertake this study in the authority in which the investigator was employed was a pragmatic one. Although approval was obtained to conduct the research in a neighbouring district, the practical difficulty of the time taken travelling to meet the nurses when they received a referral proved to be too great to enable sufficient subjects to be recruited.

Time spent collecting data was an important factor in this study. Visits varied in length but were always between thirty minutes and an hour's duration. The recall session was the length of the visit plus the time take by the nurse to report on her cognitive processes during the visit. This represented a high investment of time for the nurse subjects who were practising nurses. In all it took six months to complete eight assessment visits. (Two of the subjects were observed on two occasions).

One of the main strengths of the approach described is the richness of the data it yields, although the time required to collect and process it necessarily limits the amount of data that can be obtained. Carroll and Johnson (1990) acknowledge this approach as costly and time consuming and point out that studies typically include twelve or fewer subjects. Fonteyn et al (1993) suggest that this research method, like other qualitative methodologies, seeks rich, in-depth data from a small sample. Kuipers and Kassirer (1984) also make the case for in-depth data in relation to a
number of individuals suggesting that a methodology designed to illuminate the undoubted complexity of human knowledge requires rich data about individuals rather than data about a population. This puts into context the eight assessments investigated under the constraints of this study.

Given that this was a relatively new area of research high priority was placed on achieving ecological validity and so the study was conducted in the field setting. A further rationale for this decision was that it would provide data for developing valid simulations as a basis for further study. The small number (n=8) of assessments investigated needs to be balanced against the benefits of a high fidelity approach. It is considered that this high value, low volume approach was correct at this stage of the research. It was important to gather rich data in the initial stages which could then suggest areas for further and more detailed study.

An alternative to this approach, which would have increased the number of subjects and therefore the generalisability of the findings, would have been the use of simulations. However, it was known that there are many more variables in the community setting, which would impinge on the decision making process, than in the hospital setting where previous simulations have been used. There was no other work known to the investigator which described an assessment visit in sufficient detail to provide a basis for developing a simulation.

3.2.3 Task analysis

Task analysis involves describing the decision maker and the decision to be made or problem to be solved. Svenson (1989) suggests that there are a number of
characteristics of the task that will effect the verbal protocols elicited, such as whether or not a task is familiar is one. Subjects are likely to have cognitive strategies already available for solving familiar tasks but these may have become highly automated and therefore more difficult to capture through verbal reporting. The importance of a task is also a factor, with Svenson (1989) suggesting that important tasks will generate more thorough information processing and more complete protocols. The number of aspects of the task will be an indicator of its complexity with a greater number of cues increasing the difficulty of the task. However, tasks with less than four attributes or cues are unlikely to yield useful verbal protocols. In this study the task in all eight assessment visits was to identify the patient's nursing problems and decide what action to take. This was a familiar task to all subjects and their level of experience as judged by time spent in their role was assessed. It was envisaged that the combination of both the assessment visit protocols and the retrospective reports of subjects' would enable the cognitive strategies of the nurses to be identified. As the study took place in the field, nurses were making judgements about the care required for real patients who were potentially going to be admitted onto their caseload. There was therefore a high degree of importance attached to the task. Finally the task could be judged as extremely complex with a large number of cues being presented across a range of topics.

Prior to each assessment visit the assessment task was analysed to identify the separate elements. Rock et al (1987) adapted the tetrahedron model described by Jenkins (1979) to identify the major factors that may influence the process of clinical judgement. These were:
• **Characteristics of the therapist** – to include skills, knowledge, experience,
• **Criterial tasks** – to include diagnosis, case formulation and treatment planning,
• **Clinical materials** – such as patient interview, case notes, test results and
• **Information processing activities.**

This framework was used to analyse the problem solving task to be completed by the nurses in this study. The criterial tasks for all eight assessments were considered to be firstly, identification or diagnosis of the patient’s nursing problems and secondly, formulation of a treatment plan to address these. The information processing activities of the nurses were the object of the study.

Prior to the assessment visit the investigator met up with the District Nurse to collect data necessary for the task analysis. This included information about the nurse herself and the clinical materials she had relating to the patient to be assessed.

The following table (table 3.1) gives details of the characteristics of the nurse subjects and the clinical materials available to them prior to commencing the visit. The latter largely consisted of information given by whoever referred the patient to the District Nursing service, although in two cases the patients were known to the District Nurse from a previous episode of care.
Table 3.1 Task analysis of the assessments investigated

<table>
<thead>
<tr>
<th>CASE</th>
<th>SUBJECT</th>
<th>NURSE SUBJECT CHARACTERISTICS</th>
<th>CLINICAL MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Age Group</td>
<td>Sex</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>40-44</td>
<td>F</td>
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<tr>
<td>2</td>
<td>1</td>
<td>Same Subject as For Case One</td>
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<tr>
<td>3</td>
<td>2</td>
<td>25-30</td>
<td>F</td>
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<td>4</td>
<td>3</td>
<td>50-55</td>
<td>F</td>
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<td>5</td>
<td>35-40</td>
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</tr>
<tr>
<td>7</td>
<td>6</td>
<td>40-45</td>
<td>F</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>Same subject as for Case Seven</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Table 3.1 shows that there were some differences between the visits, as might be expected. In cases one and eight the nurse subjects had encountered the patients previously. The nurse who undertook assessment three technically did not meet the inclusion criteria for the study in that she was a student District Nurse nearing the end of her course and about to qualify.
However, it was decided to include this assessment in the final analysis because she was practising in the role of a District Nursing Sister albeit under supervision. Assessments one and two were conducted by the same subject as were assessments seven and eight.

3.2.4 Procedures

The first visit to a new patient is referred to by District Nurses as an assessment visit and the investigator needed to establish a way of accompanying District Nurses on such visits as this presented the first time they would encounter patients and begin to determine their requirements for nursing care. Having recruited the nurse subjects to the sample they were asked to contact the investigator when they received a referral. Arrangements for obtaining patient consent to the visit being tape recorded were made on a case by case basis.

During the visit the investigator acted as a non-participant observer for the large part. However, there were occasions when the investigator was drawn into the conversation by either the patient or the carer (if present). This involvement was purely social interaction. The investigator's presence at the visit was useful for two reasons. Firstly it gave an opportunity to share the visuals cues that the nurse was receiving (although it was sometimes difficult to get close enough to see wounds). This allowed an opportunity to check subjects' reported responses to these cues. As Ericsson and Simon (1984) note information available to the subject is also available to the experimenter so that the correspondence of reports with stimuli can easily be established.
Secondly accompanying the nurse gave the investigator an opportunity to identify key points in the visit to pick up on in the recall session. Although the presence of the investigator may have influenced the behaviour of the nurses during the study visits, they were used to being accompanied on visits by medical and nursing students and home care staff.

At the end of the recall session the nurses were asked how typical the study visit had been of their usual practice. They also commented on their usual style of conducting a visit and whether or not they had been aware of the tape recorder.

In order to obtain a more direct measure of the nurses' cognitive processes, each assessment visit was immediately followed by a stimulated recall session in which the tape recording of the assessment was replayed. At the beginning of the recall session the District Nurse was told that the tape of the assessment visit would be played back and that either she or the investigator could stop it at any time. It was explained that the purpose of this part of the exercise was to get at "what was going through your mind" during the assessment. It was important to ensure that the instructions given to subjects did not distort their cognitive processes or the recall of those processes as described in the previous chapter. Although nurses did stop the tape it was usually the investigator who interrupted the replay. Usually repeating what the nurse had just said was enough to prompt an explanation of her thoughts. On other occasions specific questions were asked about the reason the nurse had sought a particular item of information or the way she had responded to information received.
To conclude the recall session the nurse was asked to give a summary of the patient’s problems as identified during the course of the visit. Nursing problems were defined as those problems with which the patient presented that were amenable to nursing intervention, either directly or through referral to another service.

One difficulty that was encountered by the investigator was that of staying detached from the clinical issues. Often the nurse subjects in the course of their reflection would pause and ask the investigator what she thought. They were reminded that the investigator could not contribute to their deliberations. However, at the conclusion of the session the investigator offered a view if this was considered helpful.

The stimulated recall session was itself tape recorded and the two tape recordings were transcribed. Thus for each nurse-patient encounter two sets of data were elicited: the protocol of the visit and the protocol of the stimulated recall session. The audiotapes of the study visits and recall sessions were transcribed and prepared for analysis. There were inevitably some difficulties relating to the inaudibility of the occasional fragment of the conversation and the problem of several people talking at once which meant that some small segments of data could not be analysed.

3.3 DEVELOPING THE CODING FRAMEWORK

The coding categories which related to the testing of the research hypothesis were mainly pre determined in advance of the analysis of the protocols. This was possible because the purpose was to screen the protocols for the presence or absence of a number of cognitive processes indicative of hypothetico-deductive reasoning. Those
activities which would indicate that this approach was being utilised were identified and categories were defined that would capture them in an analysis of the protocols. The research hypothesis is based on Elstein's (1978) findings and states that four activities will occur during the identification of nursing problems:

- attending to cues
- activating hypotheses
- carrying out a hypothesis directed data search
- acceptance of a final hypothesis

Categories were therefore identified which related to:

- the acquisition of cues and their interpretation
- the activation of hypotheses or suppositions about what nursing problems might exist prior to the final identification of the nursing problem(s),
- the acquisition of further data to confirm or refute a hypothesis or supposition
- the active confirmation of a nursing diagnostic hypotheses which was considered to equate to the identification of a nursing problem.

The categories that Gale (1980) used in the analysis of her transcripts were reviewed to see if any could be usefully applied to the data collected in this study. One of the categories that was developed by Gale (1980) and used in this study was: "expecting, searching for or planning to search for specific features." Other categories developed were very similar to Gale’s (1980) and based on her approach. A complete lists of the categories developed by Gale (1980) is shown at Appendix 1.
A second group of categories were derived entirely from the data yielded by the transcripts to meet the second aim of the study which was to describe the types of decisions (other than diagnostic) made by nurses during the assessment visit. These categories therefore related to other facets of nursing practice about which nurses made decisions such as treatment and management issues. Categories in this group also encompass the data gathering activities prior to these decisions being made.

Two further groups of categories were identified in addition to those which related to the aims of the study:

- A group of categories that related to other activities which the nurse subject carried out during the course of the visit. These related to planning the visit, establishing the patient’s comfort, giving the patient instructions during treatment, and giving information or advice.

- A group of categories to identify situations, usually in the recall sessions, in which the nurse gives an explanation of her own practice or evaluates her performance.

Finally two further categories were identified to capture:

- all patient initiated verbalisations

- all remaining verbalisations.

The coding categories which relate specifically to the study aims are described below whilst the full coding framework is described at Appendix 2. Sixteen categories were developed to test the research hypothesis that in the course of assessing patients and identifying nursing problems District Nurses attend to cues, activate hypotheses and carry out a hypothesis direct data search. The title of the category is shown in italics.
and the category number follows in brackets. Each category is defined and examples of data from either visit or recall protocols which were assigned to this category are given.

**Acquires cues (1)**

The District Nurse (DN) asks questions to obtain information on a new topic, prior to any evidence of hypothesis formation.

Example: Up until now how have you been?

Do you take any tablets?

What is your date of birth?

Do you sleep well?

**Plans cue acquisition (1a)**

The DN expresses an intention to gain more information or to stop collecting further data.

Example: I ought to take your temperature

There’s no point in asking her about caudication – she doesn’t walk far enough.

**Attends to cues (2)**

The DN responds to cues given by the patient and shows recall of cues during the stimulated recall session.

Example: Oh, just one at night then (reading medicine bottle label)

Your son lives quite close then.

It was very painful at night

The open bit was tiny
It wasn’t massively inflamed. 

Interprets cues (3)
The DN uses a term, phrase or statement which indicates she has made some interpretation of the information available thus far.

Example: There’s not a lot to come off
You’re walking around quite well. You’re slow but…
Oh well, that’s reasonably good
I got the impression they were for the leg - recall session

Validating an inference/checking information (25)
The DN asks a question or makes a statement to test an inference. The DN checks information she already has with the patient.

Example: I should think it’s sore
Your leg’s very painful when it’s up, isn’t it?
And you had a stroke in 1984?

Makes further general/specific enquiry (4)
The DN seeks to expand or clarify information given or follows a specific line of enquiry.

Example: Was that quite a while ago now?
And what sore of BM stick do you get?
What sort of operations?
Which clinic’s that?

Where the DN is pursuing a line of enquiry a series of related questions follow one another. Data coded into this category needed to be considered in the context of the
data that had preceded it. The following examples shows the nurse asking a series of related questions (the patient’s responses are omitted). In the recall session she explained that this line of questioning was aimed at establishing the degree of control this patient had over his diabetes.

Example: P. My diabetes has always been very stable

N. What insulin do you use for your diabetes?
N. What sort of BM stick do you get?
N. Every day?
N. What do you run at for those?
N. And you always have done?

Expecting, searching for or planning to search for specific features (5)
The DN shows expectation of certain features, given the information already elicited.
Example: Does she not give you any special stockings or…?
With your water tablets do you have any difficulty that you need to go all of a sudden and you can’t hang on, or are you able to control it?
Do you have any problem with a cough when you’ve been smoking?

Active confirmation of a nursing diagnostic inference (6)
The DN gives the patient or the investigator a statement of the nursing problems she has identified or states that there are no nursing problems.
Example: So generally your main problems are that you don’t walk very well and you don’t get out and about a lot, and that you get these recurrent problems with your leg.

I think at the moment she hasn’t got many nursing needs. I think she’s got may be a few social ones….

Pre-diagnostic or non-diagnostic interpretation of clinical information (15)
The DN makes an inference without giving a nursing diagnostic inference. These inferences are about possible diagnoses, treatment and the patient’s ability to carry out their activities of daily living.
Verbalisations which fell into this category only occurred during the recall sessions.  
Example: I wonder if it was something like calciferol injection – I’m sure it is.  
It’s more than just stress incontinence isn’t it?  
Unless he actually… the wound opened up that day and he had to go down and be resutured.

_Hypothesis directed data search (39)_

The DN acquires cues in relation to a particular inference. The data in this category largely comprised verbalisations which were explanations given by the nurse in the recall session of what lay behind a particular line of enquiry.

Example: I wondered if he had some sutures that had got infected and ten days post-op, you know, he’d had secondary infection.  
I wondered whether it was just sort of – you know, you have the uremic itching post surgery, I’m sure it might [be].  
Whether he has any neuropathic ulcers.

_Identified the confirming cue/cue cluster (33)_

The DN identifies what it was that led her to accept her diagnosis.

Example: When she said that I thought “oh, I must have been right.” As it turned out she couldn’t get up off the sofa without us helping her in the end any way.

_Identifies the cue which ruled out an inference (35)_

The DN receives subsequent data which rule out an earlier inference.

Example: I was thinking perhaps if he was obstructed he may have a larger tumour somewhere, but he went on to say that he, as far as he was concerned it was clear.  

I thought it was going to be stress incontinence, that it was during the day and she literally just had the one pad and she was fine, but then when she went on – I mean getting her up at night – it’s not really stress incontinence is it?
Failure to make an enquiry (12)
The DN identifies, in retrospect, her failure to make a relevant enquiry.
Example: Certainly I should have asked her about her teeth and I just didn’t

Failure to attend to a cue (41)
The DN identifies, in retrospect, her failure to attend to a cue.
Example: Oh right I hadn’t noticed the smell as we went in
I didn’t pick out at that stage that the daughter-in-law didn’t belong to the son.

Expresses confusion/surprise over data acquired (34)
Example: I did notice that she was rubbing the back of her leg and that’s a bit strange really.
I certainly didn’t expect something that size I expected an ulcer.

Anticipation or understanding of the cause of the problem (28)
The DN identifies the cause of the problem and validates this with the patient or states this during the recall session.
Example: Maybe there’s some toxicity from her foot, you know, it’s just thrown her and she’s just generally unwell.
She has been falling more than usual in the last few weeks so it may just be that her feet are hurting or whatever and she’s not balancing so well.

A further six categories were developed which relate to the second aim of the study: describing decisions other than diagnostic decisions made by nurses during the assessment visit.

Seeking information needed to plan nursing action or organise the delivery of nursing care (38)
The DN gathers information to help her decide on a course of action or arrange the delivery of care.
Example: You don’t know what size the tubigrip is do you? Is it a G?
Probably be in the morning – what time do you get up?
Do you want me to come in, towards the end of the week say, and change it prior to the hospital?

*Information gathering about the patient's treatment (40)*
The DN gathers information to ascertain what treatment the patient has or is receiving
Example: Do you know what they have been dressing it with?
Did you say they haven't been bandaging it at all?

*Possible actions reviewed (7a)*
The DN discusses and weighs up the actions that could be taken
Example: They've been putting Granuflex on that and I'm not sure what to use um...
All the dressings that were on were badly stuck so she wanted something that wasn't going to stick.
She might be suitable for a domiciliary

*Nursing action inference made (7)*
The DN makes a statement about a course of specific or individualised action/treatment which she judges should or should not be taken.
Example: I thought a bit of Granuflex is quite good and also if they will bath her here a lot of bandages would preclude that.
The care plan I'm going to leave for the moment and review when I've actually had a chance to think about it.
In any case I'll arrange for the occupational therapist to come.

*Forward planning (8)*
The DN describes an action plan for the future.
Example: As it gets better then we'll reduce it
I'll get some and use that but I didn't have any of the on me.
There's little things like that which are underlying which I need to sort out...but you do that gradually.
Organising the delivery of care (16)

The DN makes a judgement about who is going to give care, when care is to be delivered and what materials are necessary for care to be given.

Example: Not Tuesday or Thursday because you’re going to the Day Centre so it’s probably be Wednesday or Friday.
I’ll have to get that on prescription for you.

Table 3.2 summarises the coding categories that were developed in relation to the two aims of the study.
Table 3.2 Coding categories identified in relation to the aims of the study

<table>
<thead>
<tr>
<th>Study Aim</th>
<th>Coding Categories</th>
</tr>
</thead>
</table>
| To test the hypothesis that in the course of assessing patients and identifying nursing problems District Nurses attend to cues activate hypotheses and carry out a hypothesis directed data search. | Acquires cues  
Plans cue acquisition  
Attends to cues  
Interprets cues  
Validating an inference/checking information  
Makes further general/specific enquiry  
Expecting, searching for or planning to search for specific features  
Active confirmation of a nursing diagnostic inference  
Pre-diagnostic or non-diagnostic interpretation of clinical information  
Hypothesis directed data search  
Identifies confirming cue/cue cluster  
Identifies the cue which ruled out an inference  
Failure to make an enquiry  
Failure to attend to a cue  
Expresses confusion/surprise over data acquired  
Anticipation or understanding or the cause of the problem |
| To describe the decisions, other than diagnostic decisions, that occur during the assessment visit. | Seeking information needed to plan nursing action or organise the delivery of nursing care  
Information gathering about the patient’s treatment  
Possible actions reviewed  
Nursing action inference made  
Forward planning  
Organising the delivery of care |

As stated earlier other categories were also developed to enable all verbalisations to be encoded. A full list of all the categories is found in Appendix 2.
3.4 CONTENT ANALYSIS

The main approach to the analysis of the data involved seeking evidence that the processes described in Elstein's (1978) model actually occurred in practice. As Ericsson and Simon (1984) suggest, a protocol can be encoded into a sequence of instances of general cognitive processes which have been postulated by a model. Assigning data, in the form of verbalisations, to categories determines the presence or absence of these processes and the frequency with which they were employed.

Two protocols were produced for every case, the first being a direct record of what actually took place during the assessment, and the second being a retrospective account of the nurse's cognitive processes during the task. Once the audiotapes of the visits and recall sessions had been transcribed, they were given an initial read through to capture the overall picture of the clinical encounter. On the second read through the protocol was divided into segments. Initially protocols were segmented according to who was speaking: the nurse, the patient, or any other person present during the assessment. Subsequently, segments were further divided into phrases, sentences or a number of sentences relating to a particular topic. Thus the length of the segments varied according to the number of verbalisations on a particular theme. The purpose of segmentation was to break the protocol down into manageable units for coding.

The coding categories used consisted of predetermined categories and those which captured concepts emerging from the data. The cyclical, iterative process of developing a coding framework was described in the previous chapter. In this study the categories that were developed related to the cognitive processes used by district nurses and the type of decisions they made. Verbalisations that contained evidence of
decision making were scrutinised to determine the areas in which decisions were made such as identifying nursing problems, planning care or organising the delivery of care, for example. Categories were developed and applied across all transcripts until all the data contained in both visit and recall session protocols could be assigned to a category.

Where steps in the hypothetico-deductive process were directly observable e.g. cue acquisition, expectation of certain features, active confirmation of a nursing diagnosis the data collected during the assessments could be assigned to the appropriate category. The recall data enabled those elements in the diagnostic reasoning process which were not directly observable, or could only be implied from data collected during the assessments, to be identified. Evidence that these steps were undertaken was only available from the nurse subjects' accounts of their cognitive processes.

3.4.1 Validity of the data

As discussed in the previous chapter Ericsson and Simon (1993) suggest that there are three criteria to be met by verbal data if they are to be used to infer underlying cognitive processes:

- relevance
- consistency
- memory

The protocols relating to the eight cases were assessed to see if these criteria were met. In the assessment protocols the majority of segments were coded as cue acquisition and makes further general/specific enquiry, the latter accounting for the
greater number of verbalisations. In other words, subjects were gathering data and moving forward on the basis of this information to seek further data in their search for a solution. The verbalisations demonstrated progress through the problem solving task towards a solution. It can be argued therefore that the verbalisations during the visit were relevant to the task. The data elicited in the recall session confirmed that the verbalisations during the visit were directly related to solving the clinical problem of establishing the patient’s need for nursing care.

In terms of consistency the visits followed a pattern whereby the nurse would open a new topic, usually by seeking information on a new subject, and then subsequently develop and expand on this topic by making further enquiries. Sometimes it was the patient who introduced a new topic but this was picked up on and pursued by the nurse in the same way. Where a new topic was introduced that seemed inconsistent with previous verbalisations, the nurse was found to be following the assessment documentation she was required by local policy to complete. This consisted of a series of headings based on the activities of daily living. There were some other occasions when the nurse’s verbalisations seemed inconsistent with the problem solving task but a rationale for this was given during the recall session. For example, in case one the nurse was dressing the patients leg ulcer. She commented, “I’ll need a few more things if I am going to come and dress it. O.K. Do you have Home Help?” When she was asked to explain the juxtaposition of that question to verbalisations related to the dressing she explained that she had begun to think ahead as to how the patient would obtain some dressings in time for the next visit. One options would be to ask the Home Help to pick up a prescription. This question was therefore relevant in solving the treatment dimension of the problem and logically consistent with the
subject of the ulcer dressing. It was therefore possible to demonstrate that the verbalisations during the visits met the consistency criterion. The contribution of the data elicited in the recall sessions to this evaluation should be noted.

Verbalisations during the visits and recall sessions readily met the memory criterion. Nurses remembered and referred to comments made by patients at an earlier point in the visit and in the recall sessions they were able to quote word for word what the patient had said where this was considered to be a salient piece of information.

As Gale (1983) points out, the implementation of the research method itself may be a source of diminished validity and reliability. In this study the presence of the investigator and the use of a tape recorder could have had an impact on the behaviour of the nurse subjects. In order to assess the extent of this potential impact subjects were asked how typical the visit had been of their usual practice. In six of the eight cases the nurse subject said that the visit was typical of her usual practice, although one stated that she felt self conscious.

Where subjects felt that the visit was not typical this related to patient characteristics rather than features of the methodology per se. In case 2 the patient’s mental condition made her a very poor historian which significantly curtailed the nurse ability to follow her usual approach in relation to the clinical interview. In case 8 the nurse felt that her prior knowledge of the patient meant that she was able to focus only on additional pieces of information she needed rather than taking a full history which would have been her usual practice with a new patient. However, the implication of this explanation is that this approach was her usual strategy in dealing with the
referral of known patients. The impact seems to have been on the breadth of topics covered rather than on her style of practice. It was therefore concluded that the presence of the investigator had not altered the typical behaviour of subject and that the approach described provided a valid method of measuring district nurses’ problem solving within an assessment visit.

3.4.2 Reliability of the Coding Framework

The reliability of the coding schedule was established using inter-rater reliability. The consistency of the coding between the researcher and an independent coder was measured on a sample of 12% of the data (one assessment protocol and one recall protocol). The degree of agreement was calculated by measuring the percentage agreement between the coders and by using Cohen’s (1960) Kappa. The percentage agreement indicates the number of occasions on which raters made the same judgement in relation to an item of data, as a percentage of the total number of judgements made. However, it is suggested that percentage agreement may falsely inflate the estimate of agreement by ignoring those agreements which would have occurred by chance alone (Brennan and Hays 1992). The Kappa statistic indicates the extent of agreement beyond that expected to occur by chance. It can be represented in the following way (van Someren et al 1994).

\[
Kappa = \frac{(Proportion \ of \ data \ corresponding - \ expected \ proportion \ corresponding)}{(1 - expected \ proportion \ corresponding)}
\]

A Kappa value of 0 is obtained when the level agreement is the same as that expected by chance and a Kappa value of 1 represents total agreement. Landis and Koch
(1977) have suggested the following guide to interpreting the strength of agreement between raters using Kappa.

**Table 3.3 The strength of agreement of Kappa values (Landis and Koch 1977)**

<table>
<thead>
<tr>
<th>Kappa</th>
<th>Strength of Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.20</td>
<td>Slight</td>
</tr>
<tr>
<td>0.21 - 0.40</td>
<td>Fair</td>
</tr>
<tr>
<td>0.41 - 0.60</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.61 - 0.80</td>
<td>Substantial</td>
</tr>
<tr>
<td>0.81 - 1.00</td>
<td>Almost perfect</td>
</tr>
</tbody>
</table>

The table below (table 3.4) shows the results of the measurement of inter rater reliability on 12% of the data in terms of percentage agreement and Kappa value.

**Table 3.4 Inter rater reliability**

<table>
<thead>
<tr>
<th>Percentage agreement</th>
<th>68%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa value</td>
<td>0.61</td>
</tr>
</tbody>
</table>

3.5 **RESULTS**

As described in section 3.4 the main approach to the analysis of data was to seek evidence that the processes described in Elstein’s model of diagnostic reasoning occurred in the course of a nursing assessment. The second aim of the study was to identify decisions, other than diagnostic decisions, made by nurses. The analysis of the results therefore involved determining whether is had been possible to assign data to the coding categories depicting cognitive processes and those related to other types of decision making. Thus, although all the verbalisations in the 8 assessment and
recall protocols were assigned to a category from the schedule shown at appendix two, the analysis that follows focuses on the categories which relate to the two aims of the study.

Table 3.5 shows the frequency with which verbalisations made during the assessment visits were assigned to coding categories, by case.
Table 3.5  The frequency of verbalisations made during an assessment that depict cognitive processes and types of decisions made.

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>CASES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Acquires cues</td>
<td>39</td>
<td>27</td>
</tr>
<tr>
<td>Plans cue acquisition</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Attends to cues</td>
<td>6</td>
<td>46</td>
</tr>
<tr>
<td>Interprets cues</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Validating an inference/checking info.</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Makes further general/specific enquiry</td>
<td>47</td>
<td>22</td>
</tr>
<tr>
<td>Expecting, searching for or planning</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>for spec features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active confirmation of nursing diagnosis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Anticipation of the cause of the problem</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Seeking information to plan the delivery</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Information gathering about patient's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible actions reviewed</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Nursing action inference made</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Forward planning</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Organising the delivery of care</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,052</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 3.5 shows that verbalisations could be assigned to categories which largely depicted cognitive activities in relation to seeking and acquiring information or cues. Verbalisations could also be assigned to categories depicting decision making in relation to selecting nursing intervention or planning care and organising the delivery of care. Table 3.6 shows the percentage frequency with which verbalisations were assigned to the respective coding categories.

**Table 3.6 Percentage frequency of occurrence of coding categories**

<table>
<thead>
<tr>
<th>Coding category</th>
<th>Percentage frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makes further general/specific enquiry</td>
<td>30%</td>
</tr>
<tr>
<td>Acquires cues</td>
<td>23%</td>
</tr>
<tr>
<td>Validating an inference/checking information</td>
<td>15%</td>
</tr>
<tr>
<td>Attends to cue</td>
<td>7%</td>
</tr>
<tr>
<td>Interprets</td>
<td>6%</td>
</tr>
<tr>
<td>Nursing action inference made</td>
<td>5%</td>
</tr>
<tr>
<td>Plans cue acquisition</td>
<td>4%</td>
</tr>
<tr>
<td>Seeking information needed to plan the delivery of care</td>
<td>2%</td>
</tr>
<tr>
<td>Possible actions reviewed</td>
<td>2%</td>
</tr>
<tr>
<td>Organising the delivery of care</td>
<td>2%</td>
</tr>
<tr>
<td>Expecting searching for or planning to search for specific features</td>
<td>1%</td>
</tr>
<tr>
<td>Information gathering about patients’ treatment</td>
<td>1%</td>
</tr>
<tr>
<td>Forward planning</td>
<td>1%</td>
</tr>
<tr>
<td>Anticipating or understanding the cause of the problem</td>
<td>0.7%</td>
</tr>
<tr>
<td>Active confirmation of a nursing diagnostic inference</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

From table 3.6 it can be seen that together two categories, *makes further general/specific enquiry* and *acquires cues*, account for over half of all the verbalisations during an assessment. This shows that seeking and acquiring information are the dominant activities of the assessment process. Not only did nurse
subjects collect data on a series of new topics (acquires cues) they also followed up the information they received, seeking clarification and expansion. Indeed this type of enquiry (makes further general/specific enquiry) accounted for 30% of the verbalisations. It would seem then that during the course of assessment visits nurses acquire cues and pursue specific lines of enquiry. From the verbalisations made during the assessment visits it was not possible to determine whether these lines of enquiry were hypothesis directed or not. Equally instances when nurses may have used information or cues they acquired to rule in or rule out a hypothesis could not be identified from the data contained in assessment protocols.

The recall protocols were examined to determine the extent to which verbalisations could be assigned to the coding categories relating to the two aims of the study. Table 3.7 shows the number of verbalisations made within each category during the recall sessions.
Table 3.7 The frequency of verbalisations made during recall sessions that depict cognitive processes.

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>CASE</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plans cue acquisition</td>
<td>1</td>
<td>14</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>37</td>
</tr>
<tr>
<td>Attends to cues</td>
<td>2</td>
<td>7</td>
<td>16</td>
<td>4</td>
<td>10</td>
<td>21</td>
<td>34</td>
</tr>
<tr>
<td>Interprets cues</td>
<td>3</td>
<td>39</td>
<td>19</td>
<td>22</td>
<td>22</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Validating an inference</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Makes further general/specific enquiry</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Expecting searching for or planning to search for specific features</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Active confirmation of a nursing diagnostic inference</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Pre-diagnostic or non-diagnostic interpretation of clinical information</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Hypothesis directed data search</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Identifies the confirming/refuting cue or cue cluster</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Identifies information which ruled out an inference</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Failure to make an enquiry</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Failure to attend to a cue</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Expresses confusion/surprise over data acquired</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Anticipation or understanding of the cause of the problem</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Seeking information needed to plan nursing action or the organisation or care</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Information gathering about patient’s treatment</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Possible actions reviewed</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nursing action inference made</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Forward planning</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Organising the delivery of care</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

102
The vast majority of verbalisations, almost 60% indicated that nurse subjects had attended to cues and made some sort of evaluation or interpretation of them. Thus the recall data suggests that as well as seeking and acquiring information nurse subjects are processing this information to derive meaning from it. Table 3.7 also shows that verbalisations from the protocols of recall sessions provide evidence of nurses seeking cues in relation to an inference or hypothesis that is under consideration. The following reasons were given by nurse subjects as to why they were collecting particular pieces of information.

“That as why I made up my mind I must check her BM stick. That [diabetes] was one of the things I was thinking about” (Subject 2).

“Whether he had any neuro-pathic ulcers” (Subject 3)

“I was thinking of stress incontinence... obviously if she's got a repair problem – I just wanted to see by jogging her memory about the hysterectomy.” (Subject 6).

From the extracts above it is apparent that the hypotheses or diagnostic possibilities that nurse subjects were considering encompassed both medical diagnosis, such as diabetes, and other clinical states or entities that were likely to be consequences of the patient’s medical condition, such as neuro-pathic ulcers and stress incontinence. This data provides some evidence of the type of phenomena around which nurses identify problems which require nursing intervention.

In addition to the cognitive activities already discussed, data from the recall protocols could be assigned to the following categories:

- Expecting, searching for or planning to search for specific features
- Anticipation or understanding of the cause of the problem
- Expresses confusion/surprise over the data acquired
The first of these categories, in particular, implies that the nurses subjects had some kind of internal mental representation of the likely characteristics of a patient who had the sort of clinical profile that the presenting patient had. This representation underpinned the problem solving process, guiding what data they collected on what topics and in what order. Sometimes the nurse’s expectancy related to the clinical features, signs and symptoms, they might see in the circumstances:

“Have you lost some of your movement since the stroke?”
“Did you find when you had your jaundice your diabetes changed quite dramatically?”
“Did you get shaky and things like that?”
“Did you have any heart trouble prior to the thrombosis?”

On other occasions their expectations related to the type of treatment a patient with these clinical characteristics might receive and the possible consequences of some treatments.

“Did she give you any special stockings?” [anti-embolic, following a DVT]
“With your diabetes do you keep a regular check on your feet?”
“With your water tablets do you have any difficulty that you need to go all of a sudden and you can’t hang on.”

The nurse subjects showed anticipation and understanding of the cause of the problem that the patient was presenting with. Again this suggests that their internal representation of the clinical problems included a etiological factors. Thus in case 2 the nurse subject asked the patient if her feet felt cold, or whether she could not feel them very well. In the recall session her rationale for this question was:
"An observation that her circulation wasn’t very good, the legs were quite ischaemic and she was diabetic and Phil had already told me that she’s been walking around with ulcers and she doesn’t know she’s got them.” (Subject 1)

There were also occasions where the nurse subjects expressed confusion or surprise over the data they were receiving. Thus nurse subject 6 found it difficult to equate the leg ulcer the patient had with the pain she described:

“Well I was surprised at how small it was. I actually thought we were wasting our time there in may ways... I mean obviously she needed advice and she was a little bit anxious but I certainly didn’t expect something that size, I expected an ulcer. I mean that was like the size of a pin head.”

Nurse subject 1 was confused by the fact that the patient was still taking Ventolin (a bronchodilator) when she had reported asthma as an old problem:

“It seemed to be a long time ago...it didn’t seem to be... she said I had asthma – not I’ve got it so...I rather let it go and was actually quite surprised to see the ventolin.”

Thus verbalisations assigned to the categories expecting, searching for or planning to search for specific features and anticipation of the cause of the problem provide evidence that suggests that nurses have an internal representation of clinical problems which includes the predisposing factors, the clinical characteristics and the likely intervention or treatment. Where data is acquired that does not “fit” or contradicts these expectations the subjects express confusion or surprise. It would therefore appear that the knowledge nurses have in respect of the clinical entities they encounter is as important for problem solving as the cognitive processes they use.

The results show that the main activity within the assessment visit is the acquisition of data. Nurse subjects appear to use their knowledge to interpret this data and activate a hypothesis. They are then able to determine what data should be collected subsequently.
The second aim of the study was to establish what types of decisions, other than diagnostic decisions, nurses made. The underlying assumption was that nurses made diagnostic decisions during the course of an assessment. The results from the assessment visits (table 3.5) showed that only one nurse in case one actually stated the patient's nursing problems during the courses of the visit. At the end of the visit she summed up what she considered to be the patients' three problems:

“So generally your main problems are that you don't walk very well and you don't get out and about a lot and that you get these recurrent problems with your leg.” (Subject 1)

However, data from the recall sessions (table 3.7) showed that diagnostic inferences were made in all cases with two nursing problems being identified in six out of the eight cases. Nevertheless these statements were largely elicited by the investigator prompting the subjects to summarise the patients' problems at the end of the recall session. Even when nurses were specifically prompted to list nursing problems they still talked in terms of nursing actions. Some examples of nurses responses to the prompt at the end of the recall session are given below;

“Well basically at the moment he’s self caring and we need to go in and do his wound dressing.” (Subject 6).

“I mean she obviously doesn’t need that much in the way of nursing care. I think I will go back on Monday… I will go back next week, hopefully the leg ulcer will be clearing up very soon. I will supply support stockings because I think that will help to temper the problem in future and if she can be encouraged to remain fairly independent by having bath aids and whatever I think that’s the road to go down rather than put in a lot of help which she doesn’t need.” (Subject 5).

“Her – well my problem more than her problem – is actually finding out what is going on…. I feel that I probably need to speak to either her keyworker or an officer who knows her or who knows a bit more about her. I mean the
immediate problem is dressing the toes but we need to look at what's happening generally.” (Subject 1).

Even when nurses did respond to the prompt by identifying nursing problems they rapidly moved on to discuss the action they would need to take as a result and spent far longer outlining this, an indication of the priority they gave to the action component of the assessment process.

“I’d say she’d got this leg ulcer and her legs were very oedematous. I mean I don’t know what we can really do about them any way but if one leg does go down with the tubigrip bandaging then I think personally I would tend to put tubigrip on the other leg and then see.” (Subject 4)

It would seem then that nurse do not make diagnostic statements as often as nursing action statements and that even when prompted to cite nursing problems they frequently describe their actions in response to the problem. Thus in addition to identifying the patients’ nursing problems, other areas of decision making during the assessment included reviewing possible actions, deciding on a course of action and to a lesser extent organising the delivery of care (Table 3.7).
3.6 DISCUSSION OF THE FINDINGS

3.6.1 Review of the Coding Framework

On completion of the study the coding framework was reviewed to determine the precision with which it had enabled data to be categorised. This suggested that for future application some refinement of the categories would be helpful. For example, the category validating an inference/checking information was considered too broad.

The act of validating an inference involved the nurse making some interpretation of the cues she had received and testing this out – “That looks sore,” for instance. This was clearly a very different cognitive activity than simply checking factual information she had already been given such as the patient’s GP and so on. For this latter activity no interpretation of cues was required and it was therefore less cognitively demanding and did not require the nurse to use her clinical knowledge.

The category DN refers to past experience to explain current inference/action may have more usefully referred to evidence that the nurse was using her knowledge base, albeit derived from past experience. This would potentially increase the breadth of data which could be assigned to this category and more accurately describe the nurses’ cognitive activity in this respect.

The categories of cue proffering and cue seeking both relate to verbalisations by patients and are probably more simply described as “patient statement” and “patient question” as the categories may be confused with those that describe the cognitive activity of the nurse.
Finally an overview of the whole coding framework suggests a more fundamental issue. It would appear that in the desire to distinguish between different types of decisions made the concepts of content and cognitive strategy may have become confused. Thus the categories seeking information needed to plan nursing action or the organisation of nursing care and information gathering about the patient's treatment describe both the cognitive activity, which is really about searching for information or cue acquisition, and the purpose of the activity or the type of decision it relates to.

The coding framework for the second study will be designed to distinguish between the topics that nurses focus on, which are an indicator of both the content of their clinical knowledge base and the parameters of the domain of nursing, and the cognitive strategies they use in clinical problem solving.

The content analysis of 8 assessment and 8 recall protocols in this study was carried out on the premise that all verbalisations, those of the nurse, patient and anyone else present, should be coded. It was considered important to do this at this stage of the research to avoid missing any elements that may contribute to an understanding of clinical decision making. However, it led to the development of an overly complicated and unwieldy coding schedule, designed to capture all verbalisations. It was concluded that only the verbalisations of the nurse subject were pertinent for the analysis of nurses' cognitive activities.
3.6.2 *Nurses clinical reasoning during the assessment task*

The first aim of the study was to test the hypothesis that nurses used a hypothetico-deductive approach to identifying patients' nursing problems. The first nine categories in table 3.5 relate to this hypothesis and 913 verbalisations were recorded during the assessment visits which could be coded in this way. The original premise was that if data could be assigned to these categories this would confirm that nurses used a hypothetico-deductive reasoning approach in the identification of nursing problems.

It would appear then that, during assessment, nurses collect data, interpret this and test their preliminary inferences about what nursing problems might exist in line with Elstein's (1978) model of diagnostic reasoning. However, this model does not provide an account of how nurses use their knowledge to identify salient cues, interpret them, activate hypotheses and decide what data to collect subsequently. There was some evidence that nurses approached the assessment of the patient armed with knowledge from the referral process, previous knowledge of the patient or pathophysiological knowledge of the patient's medical condition. This gave them a set of expectations based on the likely sequelae of a given medical diagnosis or their knowledge of the patient's condition previously. Their strategy during the assessment was therefore to confirm the degree to which the patient's status matched their expectations. It would appear that for each clinical entity they encounter nurses have a comprehensive body of knowledge that includes the aetiology, typical features, likely treatment and possible consequences.
This finding, which place a new emphasis on the knowledge and experience that nurses bring to the problem solving task as well as their reasoning strategies, is supported by the results of other studies which show that knowledge of the domain in which the subject is working is critical to successful problem solving. Elstein (1978) found that diagnostic success was “case specific” and that success in one clinical domain could not be replicated in a speciality with which the clinician was not familiar. The diagnostic competence of a physician varies across cases as the extent of his knowledge in relation to each clinical domain varies. Other studies also showed that success in problem solving in one domain did not necessarily lead to success in another (Norman and Tugwell 1982, Berner et al 1977, and Donnely et al 1982).

The finding of case specificity reflects a shift in the study of clinical decision making away from the hypothetico-deductive model, which was seen as a generic problem solving model, to a knowledge based model which highlights the organisation and availability of an individual’s clinical knowledge as stored in memory. In chapter four the literature relating to the organisation of knowledge is reviewed. Various terms have been used to describe the knowledge structures developed by experts such as mental models (Holyoak 1983, Rouse and Morris 1986) or schema (Braune and Foshay 1983, Marshall 1995). Illness scripts are seen as a particular type of schema which clinicians use to organise, and thus effectively utilise, their clinical knowledge (Boshuizen and Schmidt 1995). They are seen as having three components:

- **enabling conditions** such as the personal, social, medical and other factors which have an effect on health.
- **fault** or the patho-physiological process that is contributing to a specific disease.
consequences of the fault such as the signs and symptoms of a particular disease.

It is suggested that with experience expert clinicians have developed a large number of illness scripts and that one of these is activated when dealing with a new clinical case. There are parallels here with Elstein's idea of hypothesis activation and hypothesis testing and Schmidt and Boshuizen (1995) consider hypothesis activation and testing to be "epiphenomenon" of illness script activation. Thus the hypotheses that Elstein et al (1978) refer to could be equated with schema (Braune and Foshay 1983, Marshall 1995) in that both represent suppositions about the possible state of the patient that need to be tested further.

What schema theory and the concept of illness scripts contribute to the understanding of clinical reasoning is an explanation of how experts retrieve and apply their knowledge during clinical problem solving. They provide a useful theoretical framework for interpreting the finding that District Nurses appeared to have an internal representation of clinical problems that led them to expect and search for certain clinical features, anticipate or understand the cause of the problem and express surprise when incoming data is a "mismatch" with their internal representation. It is postulated that the internal representations that nurses have are types of schema or illness scripts and that these create an expectation of the clinical problems the patient may present with and thus direct the search for data during assessment task.

The idea that clinical problems are represented as schema or illness scripts against which incoming data can be compared has led to consideration of the diagnostic process as a pattern recognition or pattern matching process. This shift in the
paradigm of research, away from the emphasis on a generic problem solving process towards an understanding of the importance of the content and organisation of knowledge, is discussed in the following chapter.

3.6.3  Types of decisions made during the assessment task

The main assumption underlying the research hypothesis was that nurses do explicitly identify patient problems during the course of an assessment. However it was noted that only one nurse verbalised the patient's problems during the assessment visit. One possible explanation for the lack of such statements during the visit is that the nursing problems were obvious, in that they were the reason for the visit or they were identified as problems by the patients themselves. There was thus no need for the nurse to further reiterate the problems during the course of the visit.

On this basis one might expect to see more instances of active confirmation of a nursing diagnostic inference during the recall session. Indeed table 3.7 showed that subjects identified patients' nursing problems in all eight cases although it was noted that most of the statements made were in response to the investigator's prompt at the end of the recall session. It would seem then that nurses do not spontaneously verbalise patient's nursing problems within the terms of the definition used in the study.

During the eight assessment visits nurses made 48 action statements as opposed to 3 diagnostic statements. During the recall sessions, as shown in table 3.7, 27 action statements were made (nursing action inference made) compared with 17 diagnostic
statements (*active confirmation of a diagnostic inference*). A key finding, therefore, is that nurses make more statements about what action they are going to take, than about what they consider the patients nursing problems to be, both during assessments and the recall sessions.

As described earlier Ericsson and Simon (1984) have argued that verbalisations reflect the cognitive processes of subjects whilst they are problem solving. Lack of verbalisations specifically containing statements of nursing problems would suggest that this concept is not naturally used by nurses during their problem solving activity when assessing patients. This finding challenges the assumption that the main purpose of assessing patients is to identify a list of nursing problems and suggests that the focus is about determining the state of the patient so that decisions in relation to nursing action can be made. The identification of nursing problems appears to be an implicit part of this process.

The findings of this study suggest that decisions about how to respond to the patient’s condition are given greater emphasis than previously envisaged. This would suggest that the purpose of assessment is to answer the question “What do I need to do, as a nurse, for this patient, in view of his condition?” rather than merely asking “What are this patient’s problems?” The nurse in case seven sums this up when she says,

“the main thing is to actually ... to get the care done, the dressing and that was the main thing and what he had done in the operation so that if I get run down by a car tomorrow at least there’s a care plan.” (Subject six)

This finding is in accordance with that of Aspinall (1976) who found that “many nurse are still action-oriented. They go from what they see to what they do.”
Aspinall's study 22% of the nurses listed some actions as problems – a social services referral, postoperative teaching, emotional support and postural drainage, for example. In a similar way within the field of general practice clinicians have identified that in their speciality the goal is management rather than diagnosis (Brooke et al 1984). It could be argued that the same is true of District Nursing where nurses are likely to encounter patients with a range of conditions who are beyond the acute phase of their illness. In this context the purpose of nursing assessment is to clarify the impact of a, usually given, medical diagnosis on a patient's ability to carry out his activities of daily living. This clarification is sought as the basis for planning nursing intervention. Holzemer (1986) puts forward just such a view suggesting that "nursing theory of problem solving may, focus on management rather than on assessment because the goal of establishing "the" diagnosis is less important". This is not to suggest that nurses do not identify or diagnose nursing problems. However, this appears to be an implicit process with subjects moving rapidly an interpretation of the presenting data to the planning of nursing care.

It terms of the second aim of the study it is clear that nurse do indeed make decisions other than diagnostic decisions and that nursing action decisions are given greater emphasis than diagnostic decisions. In addition to making statements about what they are going to do immediately, nurses also make statements about their future long term plans for managing the patient. Again this may be further evidence that they have a mental model of the particular clinical situation which enables them to predict, and therefore plan, the patient's future requirements for nursing care.
Another area in which nurse made decisions was the organisation of the delivery of care. This was to do with deciding how often the patient needed to be seen, which member of the nursing team should visit, what materials should be in place – types of dressing and nursing aids, for example and how this should be organised.

3.6.4 The structure of the assessment task

The analysis of data in this study did not include a review of the assessment visit as a temporally evolving event. The order in which the nurse raised topics and the sequencing of cognitive processes was not measured explicitly, therefore. However, during the coding of the protocols a pattern emerged with largely consisted of subjects acquiring and interpreting cues on a specific topic and then going on to make further enquiries in relation to that topic. Sometimes the topic was concluded when the nurse subject made decisions about what actions were required and sometimes the nurse or the patient moved to a new topic after a series of questions with no apparent conclusions having been drawn. In the first case it seemed clear that the nurse collected data or acquired cues until she had enough information to decide what nursing action was required. In the second case it was not clear why the topic was changed. It was also unclear as to how the nurse decided which topics to raise and in what order. It became apparent that some analysis of the assessment process over time would be required in the main study in order to determine the sequence of nurse subjects' activities and understand how they worked through the problem solving task of assessment.
In all cases, apart from case four, the subject had been given specific reason to visit the patient. In case four the nurse subject had been asked to make a general assessment of the patient who had returned home following rehabilitation from a cerebro-vascular accident. The main nursing problem was identified during course of the visit by the patient’s carer: help required with personal hygiene. In the absence of a presenting problem the nurse needed to have some sort of framework within which to conduct the assessment. She did this by using the assessment schedule prescribed by the health authority to identify any nursing problems. When the carer expressed her difficulty the nurse agreed that this was a nursing need. Her action was to arrange for visit from the nursing auxiliary to help the patient with washing. No other nursing needs were identified and she expressed her nursing diagnostic statement in response to the investigator’s prompt as follows:

“Well he just seemed to have one main problem which was washing down below really.”

This assessment differed from the others in that the nurse had not been given a specific remit for action.

For all the other assessments the nurse was asked to visit for a particular reason. In cases one, two, five and six the nurse subjects dealt immediately with the reason for the referral, in all cases this was a leg ulcer. The subjects tended to seek cues in relation to the leg ulcer, its cause, history, past and current treatment. They examined the ulcer commenting on size, depth, the presence or absence of infection and the stage of the healing process the wound was at. They then took a decision about how to treat the ulcer on this visit and commented if they planned to change the
treatment once supplies had been obtained. In the second half of the visit subjects asked routine questions about the patient's activities of daily living. They used the prescribed schedule as a guide but did not necessarily stick to the order of questioning on the schedule. They picked up on topics that the patient introduced and that flowed naturally from one another. However, they all checked that they had completed the assessment schedule before they left.

The pattern described here may explain the fact that few nursing diagnostic statements were made during the study visits. Where the reason for the nurse's visit is addressed immediately there may be no need for the nurse to state explicitly during visit what the nursing problem is. It could be argued that the nurse has been given the nursing problem by the referring agent. It seems that where the nurse goes into the situation knowing what the problem is, her first actions are to acquire cues that will enable her to further define the problem until she is in a position to plan nursing action.

The literature reviewed earlier suggested that nursing diagnosis occurred at the end of the assessment stage of the Nursing Process. It would seem that this view is at odds with a hypothetico-deductive approach which suggests that clinicians respond to cues as they arise and generate hypotheses or activate schema or illness scripts. Evidence indicates that a clinician will respond to all the information he receives and evaluate it immediately (Gale and Marsden 1985). By way of contradiction standard nursing textbooks appear to suggest that the nurse must complete her assessment, which is equated with data collection, and then identify the nursing problems: "When all the health information is compiled, the nurse categorises pertinent data that reflects alterations in specific areas of adaptation. These alterations...constitute a nursing
diagnosis.” (Carlson et al 1982). When the constraints of working memory are acknowledged it is difficult to see how this approach could be sustained. It would require the nurse to hold all relevant cues gathered in the course of the nursing history in working memory before identifying nursing problems and formulating action plans. The issue of cognitive strain alone renders this approach unlikely.

A number of authors recognise the difficulties created by the prescribed approach. Benner and Tanner (1987) point out that “continuing a slavish use of prescribed assessment tools...actually can limit the development of more flexible ways to collect and interpret patient information. If a check list mentality develops instead of active enquiry, the nurse may not advance beyond a competent level of performance.” A similar line is taken by colleagues in the medical profession. Crombie (1963) states “the ideal diagnostic process, which in fact is used by most of us in practice, is strikingly different from the routine history taking and examination as taught to students, where it is assumed that no conjectures about possible diagnosis are entertained until the ritual is complete.”

It appears that the nurses in this study collected data to further define a given problem until they had reached a point where a decision on the nursing action required could be made. They spent the remainder of the assessment visit screening for further problems which had not been identified at the time of referral. This finding is supported by Gale and Marsden (1984) who found that clinicians used routine enquiry as a fail-safe or background search mechanism. They also noted that routine history taking usually only occurs when early interpretations or hypotheses have been worked through. The nurses in this study used their assessment schedule to assist them in this...
routine enquiry. The nurse subject in case six typified this behaviour when she said, “When I've dealt with the problem, for instance the leg ulcer, when I go back I do use the assessment form as a rough guide – really just to make sure I'm not missing anything out.”

Interestingly the nurse subject in case four seemed to feel a greater compulsion to follow the assessment schedule. During the recall session the investigator asked, “Were you following the assessment thing or...?” She replied, “I think I started off... I should have started at the beginning shouldn’t I and worked my way down, so I don’t know why I did that. I normally sort of go right the way through it, but probably if you start off with what they can and can’t do and sort of get them talking a bit more...” It appeared she interpreted the investigator’s question as a criticism of the approach she was adopting, the implication being that she should have adhered to the order of topics on the assessment form. In fact this nurse subject did rely heavily on the assessment schedule during the visit. This may have been because there was no clear remit given at the time or referral and no obvious needs on meeting the patient. The whole assessment was therefore akin to a screening process to identify the patient’s nursing problems rather than being hypothesis driven.

The subject in case three also commented quite a lot on the use of the assessment form. During the replay she noted that she had not asked the patient about his financial circumstances, but justified this by saying that his home looked well maintained and she knew he did private tuition. When the investigator asked what had prompted her concern about this omission she replied “nothing at all, but thinking now, thinking – oh the assessment process – I should have done that.” It seemed that
this nurse subject felt obliged to collect information, even if she did not consider that she needed it, because it appeared on the assessment schedule. At the end of the recall session she expressed the difficulty she had working with a prescribed assessment form.

"I think I can take a reasonable assessment just on a piece of paper. I find conversations much more freer – you pick things up – I mean listening to that tape I actually picked up more then and I thought “Oh, I didn’t that “ and it was because I was looking at this dratted piece of paper as to what do I say next.” (Subject 2)

In conclusion it would appear that nurses structure the visit differently according to whether the referral they receive gives them specific remit or not. Where a nursing issue is identified at the time of the referral the nurse takes this as her starting point for the visit. She gathers information in relation to this problem until she can decide what action to take and then follows up with a routine enquiry based on the prescribed assessment schedule in order to ensure that she has identified any other problems that may exist. Where there is no specific remit and no obvious presenting problem the nurse must impose some sort of structure on the visit in order to identify what the problems might be. Only one visit in this study fell into this category and the nurse’s underpinning strategy seemed to be to find out what the patient could and could not do for himself as an indicator of what his need for nursing might be. To do this she followed the prescribed assessment schedule. The issue of how nurses structure the problem solving task in order to identify the patient’s requirements for nursing will be examined in the second study.
3.7 SUMMARY

The findings of the first study have shown that there is some evidence of hypothetico-deductive reasoning by nurses during the course of assessing patients. However, this appears to be only a partial explanation of their approach. The nurse’s knowledge base, either of clinical phenomena or of that particular patient, seems to be critical in underpinning the problem solving process. This knowledge creates an expectation of certain clinical features and the nurse collects data to assess the degree to which the clinical characteristics of the presenting patient match this expectation.

The findings of this study also suggest that the purpose of the nursing assessment seems to be determining what the nurse needs to do in response to the patient’s condition rather than determining the condition per se.

Finally there is some evidence that nurses structure the assessment of patients differently according to whether they have a specific or non-specific remit. This hypothesis will be further tested in the second study.

If the nurse’s knowledge base is seen to play an increasingly important role in problem solving it is important to be clear about what constitutes “nursing” knowledge. Equally if nurses are not given a specific remit they must approach the assessment of patients with some underlying view about what patient characteristics are of interest and relevant to them as nurses. A review of what phenomena nurses choose to attend to will help to illuminate what constitutes nursing knowledge and what the focus of nursing is. This will be one of the aims of the second study.
3.7.1 Recommendations for the second study

- To identify nurses' cognitive activities during assessment task.
- To establish how nurses' knowledge is structured and organised.
- To examine the phenomena on which District Nurses focus and the topics they cover during an assessment task as indicators of the content of their knowledge base.
- To identify how nurses structure the problem solving task (i.e. the assessment visit)

The following chapter discusses the literatures in relation to the organisation of knowledge in memory and how this knowledge base is utilised and integrated with reasoning strategies during a problem solving task.
CHAPTER FOUR

THE ORGANISATION AND UTILISATION OF KNOWLEDGE, A BASIS FOR EXPERTISE: A REVIEW OF THE LITERATURE

4.0 INTRODUCTION

Chapter one described the early view that clinical reasoning could be described by a model of hypothetico-deductive reasoning. The findings of the first study showed that there was some evidence of hypothetico-deductive reasoning by District Nurses during the assessment of patients. However, the knowledge utilised by nurses during the problem solving task seemed to be critical in determining what information was sought from the patient and how it was interpreted. The literature reviewed in this chapter considers how knowledge might be organised in memory and how it is integrated with reasoning strategies during the problem solving task. A framework for considering the content of District Nursing knowledge is also suggested.

The importance of knowledge in problem solving was confirmed by Elstein et al’s (1978) finding that knowledge of the content area of a particular clinical problem was more critical to successful diagnosis than mastery of a generic problem solving process. They suggested that effective clinical problem solving depends on the retrieval of relevant content from a well organised store of long term memories. This means that the diagnostic competence of a clinician will vary across cases in relation to the extent of his knowledge base for each clinical domain. Diagnostic success is therefore “case specific” requiring knowledge of the specific clinical problem.
Elstein et al’s (1978) findings were supported by similar findings in other studies, namely that there was very little relationship between the performance of a clinician on one problem and his performance on a second, dissimilar problem, (Norman and Tugwell, 1982; Berner et al 1977; Donnelly et al 1982). Gale and Marsden’s (1983) study of registrars in endocrinology and neurology indicated that there are fundamental differences in diagnostic thinking processes across the specialities. These findings are also comparable with studies outside the field of medicine. Cognitive scientists demonstrated domain specific expertise in the fields of electrical engineering (Egan and Schwartz 1979) and chess (DeGroot 1965, Chase and Simon 1973).

Other studies which focused on the differences between novices and experts found that it was the content and organisation of their knowledge base which accounted for the experts’ superior performance in problem solving. Norman et al (1985) concluded that the expert was an expert not because of any innate or learned advantage in problem solving skills but simply because he knows more in his domain than the novice. In the same way Glaser (1984) suggest that the problem solving difficulties of novices can be attributed to the inadequacies of their knowledge base rather than their inability to problem solve.

4.1 ORGANISATION OF KNOWLEDGE

In the light of finding that success in clinical problem solving was related to domain specific knowledge, research shifted away from looking at problem solving in terms of process and began to explore the cognitive structure which appeared to provide the
basis for expertise. Schwartz at al (1973) stated that "sound clinical judgements derive from the command of both a sufficient body of facts and from the skill to combine such facts appropriately." Gale and Marsden (1983) make a similar point when they describe the cognitive processes of "structuring" and "extrapolating". They suggest that the clinician organises the array of clinical information with which he is confronted by structuring it in some way. He does this by referring to, or extrapolating, from information already organised in his memory in a structured way. It thus appeared that it was not just the content of an expert's knowledge base that led to his success in problem solving but the way his knowledge was organised in memory. Parrino and Mitchell (1989) suggest that information is stored in memory as a set of "representations" that stand for a network of facts. This view is supported by Egan and Schwartz's (1979) work which showed that expert electrical engineers developed mental schemata that grouped the surface features of a circuit. This provided a framework for problem solving and enabled them to recall information accurately. The studies of chess players showed that novices rely mainly on short term memory to plan move but masters use a set of internal knowledge structures to comprehend, interpret and recall chess configurations comprising a large number of chess pieces (de Groot 1965, Chase and Simon 1973).

In medicine, Bordage et al (1990) reaffirmed the shift in the paradigm of research away from the hypothetico-deductive model to a knowledge driven model of medical diagnostic thinking. The variables associated with the hypothetico-deductive model were data acquisition, hypothesis generation, data interpretation and hypothesis evaluation. The knowledge based model, however, focuses on the organisation and availability of medical knowledge stored in memory. The variables associated with
Grant and Marsden (1987) demonstrated that there is a consistent difference in the memory structures of novices and expert clinicians. They studied the performance of medical students, senior house officers, registrars and consultants during four diagnostic problems in general medicine. They found that there was no difference between the groups in the breadth of their thinking but that there were marked differences in the precise content and structure of thought. They showed that when students or clinicians are presented with clinical information they interpret it by identifying personally important pieces of information which (Gale and Marsden 1973) described as forceful features. They suggest that these features act as a key to particular memory structures which in turn give rise to clinical interpretation of the information.

The number of different interpretations made by each group for each patient were not significantly different. Novices had as many diagnostic ideas as experts. However, there was “massive” variability in the way information was memorised. This occurred not only between groups but within them. Even individuals with similar clinical experience did not have similar thoughts and having differing amounts of clinical experience gave rise to substantially different thoughts. For each clinical problem Grant and Marsden (1987) found that there was a small number of common interpretations or shared memory structures and, by way of contrast, a massive peripheral field of individual difference in the way in which information is stored, both within and between groups of clinicians.
Grant and Marsden (1987) suggested that the most important finding from this study was the extent of the individuality of the content of thinking. It appears that assessing memory structures by identifying forceful features within the information presented is common to all. However there is enormous variation in the forceful features identified and the memory structures accessed. This suggests that expertise is based on the personal relevance and utility of information in individualised memory structures. There is therefore no "best" way to problem solve and no "key" piece of information. Instead the expert has repeatedly used and revised the knowledge stored in memory so that it progressively becomes more personally useful.

In a further study Grant and Marsden (1988) confirmed the extent to which consultant expertise is based on individual experience rather than a common core of knowledge. They compared the primary knowledge base, the knowledge that can easily be recalled, of medical students, registrars and consultants. Subjects were asked to follow up four clinical problems stating what information, examinations and test they would like to perform in order to assess the patient. In all cases consultants requested fewer items than the registrars. Medical students also requested fewer items than the registrars. The authors suggest that this is because the students' primary knowledge base is only just being developed whereas consultants, in the course of clinical practice, have discarded knowledge which has proven to be of only limited personal and clinical use. The amount of knowledge does not appear to be of as much significance as its qualitative characteristics. Grant and Marsden (1988) noted the rise in knowledge used in common after formal medical training followed by a fall so that by consultant level knowledge used in common compares with that of first year medical students. It would appear that medical education increases the uniformity of
knowledge and that this effect is then reversed by experience in clinical practice. Thus it is suggested that clinicians start off with a narrow, idiosyncratic and possibly inappropriate memory store, which then increases in breadth and similarity, until it becomes a perhaps slightly narrower, more useful and finely tuned knowledge base which has been organised to respond to the demands of clinical problem solving in practice. This view can be usefully captured by the following diagram.

**Figure 4.1 The effect of experience on the organisation of knowledge.**

The effect of experience is to increase the theoretical knowledge base of the novice to that of the intermediate practitioner. The expert, however, has refined and honed their knowledge base in the light of clinical practice. Only those elements which are clinically useful are retained and knowledge is stored in a compact and coherent way. Expertise is the product of a good correspondence between the way problems present in the real world and the way knowledge is organised in long term memory. In other words there is a resonance between the way problems present and the way that they are understood by the clinician.
4.2 KNOWLEDGE STRUCTURES

With the finding that a highly organised knowledge base was the basis for expertise and success in clinical problem solving, interest grew in understanding how knowledge is organised and structured in memory.

Piaget (1970) put forward the view that behaviour is shaped by internal structures of mental operations that develop with experience. Over time these structures become comprehensive matrix structures that are increasingly cognitively powerful. Since Piaget (1970) advanced his ideas, a number of experiments have been carried out by cognitive psychologists which support this view. Thus, it would appear that information is stored as a set of "representations" or knowledge structures that equate to a network of facts (Parrino and Mitchell 1989).

Chi et al (1981) examined the representation of physics problems by experts and novices. They described a problem representation as a cognitive structure which corresponds to a problem and which is structured by the problem solver on the basis of his domain related knowledge and its organisation. They suggest that the knowledge needed to solve a particular problem is accessed when a given problem is categorised as a specific type of problem. Expert-novice differences can be accounted for by poorly formed, qualitatively different or non-existent categories in the novice representation. The expert, however, has the ability to establish rapidly the correspondence between externally presented events and internal models for these events. Chi et al (1981) found that there were differences in the way in which experts and novices represent problems with experts constructing a more "scientific"
representation based on the principles of physics whilst novices construct a naïve representation based on the problems literal features.

Various terms have been used by different authors to describe the knowledge structures developed by experts such as “frames” Minsky (1986) “strategy frames” (Miller 1975) “schemas” (Johnson- Laird 1983) and “chunks” (Feltovich 1983). A number of authors (Parrino and Mitchell 1989, Chi et al 1981, Holyoak 1983, Rasmussen 1979, Rouse and Morris 1986, Larkin et al 1980, and Jones and Schkade 1995) use the term “mental model” to describe the way in which knowledge is organised. Mental models are a collection of related facts and general principles which enable a problem to be categorised and identified as a particular type. They contain information on the characteristics of specific problems which can be used to predict the course of events and suggest solutions to the problem. This information can also be used to direct the search for data as part of the problem solving process.

More recently the organisation of knowledge has been described in terms of schema theory. Schema provide a more detailed representation of the problem with Marshall (1995) describing them as “a problem solving agent” which is comprised of four types of knowledge: identification knowledge, elaboration knowledge, planning knowledge and execution knowledge. It is suggested that schema provide a framework for the problem solver to name, classify, understand and draw inferences from data (Braune and Foshay 1983).

Within the field of clinical reasoning the concept of illness scripts has been used to describe how experts organise and utilise their clinical knowledge. It is suggested
that illness scripts can be considered as a type of schema. The following sections, 4.2.1, 4.2.2 and 4.2.3 provide a more detailed account of mental models, schema theory and illness scripts.

4.2.1 Mental models

Holyoak (1983) describes the construction of a mental model as "recognising that a problem exists, forming some initial representation (model) of it, transforming an initially vague model into one that is better specified and eventually ... using the model to plan and execute a solution." In other words, during the course of problem solving, the individual moves from a vague model to a well specified model through the process of reconstructing and testing the original model. The final model is important not only for describing and defining the problem but also for representing possible solutions. It also provides a basis for predicting the course of events, as Parrino and Mitchell (1989) suggest, mental models are representations of the environment and its expected behaviour. In the same way Rasmussen (1978) proposes that mental models are used for predicting future events, finding causes of observed events and determining the appropriateness of actions to create changes. From the descriptions of mental models across a range of disciplines, such as supervisory control, engineering and architectural design, Rouse and Morris (1986) have extrapolated the common themes of describing, explaining and predicting as the purpose of mental models.

The construction of a mental model has four main components (Rouse and Morris 1986):
• a goal – a problem to solve
• a set of objects – available data about the problem
• a set of operators or possible actions
• a set of constraints that place limits on the problem solver

It is because these components are often incomplete when the problem is first encountered that the problem solver must engage in the iterative process described above to develop a well specified model that provides a basis for solving the problem.

Jones and Schkade (1995) provide further evidence that subjects manipulate the way a problem is represented initially to a point where they can solve it. They found that subjects translated the problem they were asked to solve from the given external representation to another representation. Other research which supports this finding was conducted by Larkin et al (1980) in the field of physics. They found that subjects often translated sentences and diagrams into mathematical equations in order to access efficient problem solving strategies.

There are a number of reasons as to why translating a problem representation from the given to another is a useful strategy (Jones and Schkade 1995). Alternative representations can reduce the time and effort required to solve the problem by making a simple solution more readily apparent. For instance, Kotovsky et al (1985) found that subject’s average solution time varied by a factor of 16 across different representations of the Tower of Hanoi problem. Although informationally equivalent, alternative representations can be less cognitively demanding for the problem solver. As an individual gains experience with a particular type of problem representation their problem solving strategies tend to become more task specific and efficient (Newell and Simon 1972). Boehm-Davis et al (1989), for example, found that
subjects performed tasks better when they were given the database format that they preferred. Based on the results of their own study Jones and Schkade (1995) concluded that decision makers often translate the external given representation of a problem into a different representation, especially where this is more familiar or convenient for problem solving.

For successful problem solving the ability to retrieve the model is as important as the ability to construct it initially. As they gain experience individuals are able to recognise new situations as analogous to those for which a mental model already exists. Holyoak (1983) concludes that an important heuristic for dealing with a novel problem is to find a similar, better understood problem in the same domain and then try to transform the method and/or solution into one appropriate to the original problem. The strategy of analogous reasoning will be discussed further in section 4.3.2.

4.2.2 Schema Theory

Experienced problem solvers are able to identify presenting problems as examples of a known category of problems or a schema. Piaget (1970) proposed that schemata develop through two processes: assimilation where new information is modified by prior knowledge and accommodation where prior knowledge is modified to account for new information. A problem schema is therefore a mental model for a category of problems which contains information about similar problems and relevant solution methods. Schema theory thus attempts to describe "how acquired knowledge is
organised and represented and how such cognitive structures facilitate the use of knowledge in particular ways.” (Glaser 1984).

In a similar way Chi et al (1981) suggest that a problem representation is constructed in the context of the knowledge available for that particular problem type. A category and its associated knowledge base constitute a “schema” for that particular problem type. They propose that it is the content of these problem schemata that determine the quality of problem representation. The authors went on to consider the nature of expert problem solving and speculated that the early phase constitutes a qualitative analysis, involving the activation of an appropriate principle – oriented knowledge structure, or a schema. The activation of the schema occurs as a response to some fragmentary cue in the problem. For experts in Chi et al’s study (1981), who were studying physics problems, the knowledge contained in the schema they activated provided the general form that specific equations to be used for the solution should take. They suggest that this approach would naturally lead to a forward working style of problem solving for the expert.

This view is supported by Patel and Groen (1986) who suggest that physicians use a process of forward reasoning through a network of “causal rules” which are activated by relevant features in the problem. They conclude that these rules appear to derive from the physician’s knowledge base rather than any information presented in the problem itself. Thus forward reasoning equates to an inductive style of reasoning in which a sound knowledge base is utilised to make an interpretation of the data that leads to hypothesis generation or schema activation. Because of the requirement for a

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robust knowledge base forward reasoning is characteristic of experts. By contrast backward reasoning is a deductive style of reasoning and occurs where hypothesis generation leads to the reinterpretation of data or the collection of new data in order to test the hypothesis. This style of reasoning is characteristic of novices or experts working on a complex problem.

The key point to note is that, once activated, schema not only enable the individual to better understand and define the problem, they also suggest strategies for its solution. Braune and Foshay (1983) propose that schema perform two major functions:

- They enable a person to form expectations which tell him or her what to look for – what to select from the incoming information
- The person employs the schema to know how to deal with this data – how to name, classify and understand them, and how to draw inferences from them.

The authors summarise the general flow of information in the human cognitive system as a four stage process depicted in figure 4.2.
Figure 4.2 Information Flow In the Human Cognitive System (Braune and Foshay 1983)

<table>
<thead>
<tr>
<th>SIGNAL DETECTION</th>
<th>RECOGNITION</th>
<th>COMPREHENSION</th>
<th>EXPECTATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Something is out there – yes / no answer</td>
<td>I know what it is – I can label the stimulus</td>
<td>I understand what it means. I can interpret it within the given context.</td>
<td>Having been able to provide meaning to a stimulus allows me to infer past and future events within a probabilistic framework. Hence I can focus on the environment that will allow me to make the correct decisions.</td>
</tr>
</tbody>
</table>
Thus it can be seen that schemata enable the individual to identify, define and solve a given problem.

Within the field of mathematics a number of studies have been carried out on subjects’ perception of problem relatedness. Krutetskii (1976) found substantial differences between high and low ability students in their perceptions of problem structure. High ability students were able to:

- distinguish relevant information from the contextual details or irrelevant data in a problem statement.
- perceive rapidly and accurately the formal structures of a problem
- generalise across a wide range of mathematically similar problems
- remember the formal structure of a problem for a long period of time.

These findings were confirmed in studies by Silver (1979, 1981), in particular the tendency of capable problem solvers to notice problem structure and sort out problems on the basis of a common structure was noted.

Hinsley et al (1977) made the first explicit link between schema theory and mathematics. They concluded that their subjects had schemata for standard algebra problems and, critically, that these schemata influenced both the encoding and retrieval of information during problem solving. These studies provide further evidence for the role of schemata in understanding, defining and solving a problem.

In the clinical context, therefore, the individual’s schema will embrace both the diagnostic and treatment aspects of the clinical task. Marshall (1995) supports this view and describes a schema as “a problem solving agent.” She notes that the
elements of problem solving include recognising the problem, constructing a mental model that matches the problem to some internal representation, forming plans for solving the problem and carrying out the solution. According to Marshall (1995) these aspects of problem solving correspond to four components of schema knowledge: identification knowledge, elaboration knowledge, planning knowledge and execution knowledge. The main function of identification knowledge is pattern recognition. This type of knowledge contributes to the initial recognition of a situation, event or experience. Unlike other authors who suggest that a critical cue or forceful feature (Gale and Marsden 1983) activate a schema, Marshall (1995) suggests that pattern recognition occurs as a result of the simultaneous cognitive processing of many features. This view is supported by Massaro (1994) who suggests that in the process of pattern recognition perceivers integrate multiple sources of information in an optimal manner. It is also akin to Benner's (1982) description of skilled knowledge that affords the expert nurse a perceptual grasp of the whole situation. Thus the account of one of Benner's (1982) subject's in Section 4.3.3 shows how she integrated a number of signs and symptoms to recognise almost instantly the pattern, or diagnosis, of pulmonary embolus.

The elaboration knowledge described by Marshall (1995) is largely declarative in nature in that it is composed of concepts and facts. It contains examples from the individual's experience along with abstractions that describe these experiences. This type of knowledge enables the individual to create a mental model about the current situation. Their understanding of the current situation is based on the extent to which this mental model fits the schema template. In line with the earlier suggestion that hypothesis testing is a feature of schema theory, Marshall (1995) suggests that
identification and elaboration knowledge enable the individual to form a tentative hypothesis and test it. Recognition of a situation through the use of identification knowledge results in the formation of a hypothesis. This hypothesis is tested when elaboration knowledge is used to determine whether there is sufficient evidence to warrant adopting the schema.

The planning knowledge that Marshall (1995) refers to is the way in which the schema can be used to make plans, create expectations, and set up goals and sub-goals. It is suggested that this type of knowledge is acquired through utilising schema in practice and that schema become updated with repeated use.

Execution knowledge (Marshall 1995) is the knowledge that enables the individual to carry out plans. It consist of the techniques that underpin action such as performing a skill. It is considered unlikely that each schema has its own set of distinct procedures to be executed, although this will be the case for some. Rather it is suggested that execution knowledge will apply across a range of schemata.

4.2.3 Illness Scripts

Within the field of clinical reasoning the concept of illness scripts has been advanced as a way of understanding how experts organise the utilise their clinical knowledge. Illness scripts can be viewed as a particular type of schema and indeed their proponents describe many of the characteristics already identified in relation to schema.
Boshuizen and Schmidt (1995) describe how an individual’s knowledge structure develops as they progress from novice to expert. They suggest that initially clinicians have a knowledge network that allows them to make direct lines of reasoning between different concepts within that network. The more an individual uses these direct lines of reasoning the more these concepts cluster, so that they become able to make a direct link between the first and last concept in the line. Initially this process was described by the authors as “knowledge compilation” (Schmidt et al 1990). Later the term “knowledge encapsulation” was used by Boshuizen and Schmidt (1992) as this better described the clustering aspect of the process. These concepts clusters frequently have clinical labels such as “micro-embolism” or “extra-hepatic icterus.”

As the clinicians’ expertise increases there is a transition from a network-type of knowledge organisation to another type of structure that Boshuizen and Schmidt (1995) refer to as “illness scripts.” Illness scripts are described as having three components. The first relates to the enabling conditions of disease in other words the personal, social, medical, genetic and environmental factors which have a positive or negative influence on health. The second component is the fault or the pathophysiological process that is contributing to a specific disease. The third component consists of the consequences of the fault such as the signs and symptoms of a particular disease. Illness scripts are activated as a whole with all elements of the script being activated automatically and immediately. When solving a clinical problem a physician may activate one or two illness scripts and match the various elements to information provided by the presenting patient. Schmidt and Boshuizen (1995) suggest that illness scripts not only involve matching information volunteered by the patient, but also generate expectations about other signs and symptoms the
patient might have. Thus illness scripts form a template to drive the assessment of the patient by providing a list of phenomena to search for. The idea of an activated knowledge structure creating an expectation of other features and thus driving the data collection process until the problem is solved was a critical point in the previous discussion of schemata. In the course of solving the clinical problem the script becomes instantiated, in other words the expected values are replaced by real findings. Instantiated scripts remain in the physician’s memory as examples of successfully solved clinical problems and are used in the diagnosis of future similar clinical problems.

It is suggested then, that medical experts have a large number of illness scripts which organise the enabling conditions and consequences of specific diseases and that these scripts are activated when dealing with a clinical case. Activation is triggered by receiving information relating to the enabling conditions or consequences of a particular disease.

There are parallels here with the idea of hypothesis generation and testing. Indeed Schmidt and Boshuizen (1995) suggest that “expert hypothesis activation and testing can be seen as epiphenomenon of illness script activation and instantiation.” The process is seen as automatic and unconscious. Only when there is a gross mismatch between the illness script and the information from the presenting patient is the clinician required to undertake active clinical reasoning using encapsulated knowledge.
Bordage et al (1990) also describe the process whereby clinicians access organised knowledge stored in long term memory. As outlined earlier they suggest clinical interpretation depends on the recognition by the physician of personally relevant pieces of information called forceful features. These act as a key to particular memory structures which in turn give rise to clinical interpretation. Like Schmidt et al (1995) they suggest that this internal memory structure directs the search for further information. “Interpretation of the clinical information is followed by a process of expectation of the presence of confirming or excluding features, governed by the precise contents and organisation of knowledge in memory”. (Bordage et al 1990). The organisation of clinical knowledge in long term memory is therefore considered paramount to diagnostic success.

Bordage et al (1984) suggest that most diagnostic errors are due not to lack of medical knowledge but to a failure to access relevant knowledge already in memory. Lemieux and Bordage (1986) identified four categories of medical knowledge: low-knowledge because knowledge is either absent or inaccessible through lack of proper organisation; high, dispersed knowledge where knowledge is present in memory but lacks organisation giving rise to a symptom by symptom analysis of the clinical problem; high, elaborate knowledge where knowledge is well organised in memory according to abstract properties embedded in clinical cues giving rise to a more global representation of the problem, and high, compiled knowledge where the elaborate networks of knowledge have been condensed down by experience. The last category applies mostly to experts. The goal of clinical practice is the solution of clinical problems as they present in the clinical setting. The organisation of knowledge is therefore critical because it determines how information is retrieved from long term memory.
memory and used in problem solving. Section 4.3 examines the thinking on how experts utilise their knowledge during clinical reasoning.

4.3 UTILISATION OF KNOWLEDGE

The goal of problem solving is to determine what state pertains in the external environment. In clinical problem solving, therefore, the goal is to ascertain the state of the patient; thus in medicine the goal is diagnosis while in nursing the purpose is to assess the patient’s condition as a consequence of their diagnosis.

A number of ways in which clinicians use their knowledge during clinical problem solving have been described. Pattern recognition is a strategy whereby clinicians compare the presenting situation with a schema or illness script to determine the state of the patient.

Analogous reasoning is a strategy that is used when experts encounter a new or novel problem. They attempt to identify features in the new problem that have similarities with problems they have encountered previously. Experts who organise their knowledge in terms of abstract principles are more likely to recognise the similarities between different problems.

Intuitive reasoning describes the way in which clinicians rapidly reach a judgement about the state of the patient without any conscious reasoning process. A characteristic of intuitive reasoning is that clinicians rapidly assimilate the clinical information available as a total picture, rather than focusing on individual features.
Finally the Recognition Primed Decision Model describes the way in which individuals dealing with problems in the naturalistic setting rapidly assess the situation and generate a feasible course of action. The tenets of this model have many similarities with the other approaches to reasoning described here. The following sections examine in more detail the problem solving strategies outlined above.

4.3.1 Pattern Recognition

A more detailed understanding of the highly organised knowledge structure of expert clinicians led to the view that diagnosis may be a process of comparing the information about the presenting patient with a "schema" (Bordage and Zacks 1984) or "illness script" (Schmidt et al 1990) held in memory. Indeed Bordage et al (1990) suggest that "diagnostic decisions are then reached through a process of comparing and contrasting the clinical information and the diagnoses using the various abstract relationships rather than by simply adding signs and symptoms." The process was considered to be one of pattern matching or pattern recognition.

The discussion of the diagnostic process as a form of pattern recognition largely centres around two schools of thought on how knowledge is organised and categorised. Diagnosis of a new case may either be the result of matching to specific instances or a more abstract prototype.

According to the instance-based recognition model a new case is judged by its resemblance to a particular patient the physician has previously encountered and
given the same diagnosis. Elstein (1995) suggests that support for this model comes from the fact that clinical diagnosis is strongly affected by the context of events, such as the exact location of a skin rash, even when this context is normally irrelevant. "These context effects suggest that clinicians are matching a new case to a previous case, not to an abstraction from several cases, since the abstract would not include these irrelevant features" (Elstein 1995). Experts have the advantage of a much larger knowledge store of previously encountered clinical problems. There is some suggestion that this theory of clinical reasoning has been developed with particular reference to specialities where the clinical data are predominantly visual. Cox (1988) suggests that "when a picture is strongly pathognomic, the limp of a stroke, the stare of exophthalmos, the colour and shape of melanoma, the slump of depression, the facies of Parkinsonism, the recognition from a pattern stored in "clinical memory" is so immediate as to be called "intuitive". He also acknowledges that to recognise patterns one must first have experienced them.

The prototype model purports that physicians construct abstractions based on previous experiences. Information held in memory is organised and categorised according to a "family resemblance" principle (Medin 1989). The prototype is a mental representation that is an example or ideal, possessing all the characteristic features of the category. As Bordage and Zacks (1984) suggest it captures the meaning of the category. Experts are differentiated by the content and complexity of their prototypes. Bordage and Lemieux (1991) and Lemieux and Bordage (1992) suggest that experts have constructed more diversified and abstract sets of semantic relations, ways of representing the links between clinical features or aspects of the problem. Some examples of these semantic relations are: duration of pain: intermittent v. constant;

Support for the prototype model comes from evidence that expert physicians are more able to relate findings to each other and to potential diagnoses, and to identify what additional information is needed to complete the picture (Elstein 1993). This ability indicates that “experts are working with more abstract representations and are not simply trying to match a new case to a previous instance” (Elstein 1993).

The work of Bordage and Zacks (1984) also provides support for the prototype view of categorisation. The authors suggest that because of their representativeness and overlapping features, prototypes can also serve as an indexing scheme for the clinicians knowledge. Amongst experienced doctors there is some evidence of a wider network of knowledge, demonstrated by the greater number of interconnections among the disorders in a category. The retrieval of the prototype disorder can therefore facilitate the recall of other members of the category. Further evidence of the use of prototypical categories comes from the work of Canter et al (1980) and Horowitz et al (1981a,b) who found that psychiatrists and psychologists represent categories of mental illness in a prototypical way.

Despite the differences between the instance-based recognition model and the prototype model, both accounts of pattern matching emphasise the physician’s knowledge representation and how this compares with the presenting situation. The idea of pattern recognition as an explanation of the diagnostic reasoning process is considered by some researchers to be an over simplification of the process. Gale and
Marsden (1983) argue that in the clinical situation the physician is only ever presented with a "partial pattern," those signs and symptoms the patient is demonstrating or elects to report. He must therefore work with this limited information in some way before any kind of pattern recognition would be possible, the authors suggest. In their view the clinician must actively confer a pattern on the information he receives as it unfolds, "he must mentally juggle with it and reorganise it, not simply match it." (Gale and Marsden 1983). In other words it is the clinician's task to find meaning in the information given and establish a pattern.

Barrows and Feltovich (1987) argue in a similar vein that the idea of pattern recognition denies the complexity of the process necessary in building pattern recognition systems. They too point out that in the clinical setting data can be ambiguous and unfold over time and is therefore not available in an instantly recognised pattern.

However, the argument that the clinician must first construct the pattern from the presenting clinical data does not preclude a subsequent process of pattern matching. Indeed the prototype model described above provides a basis for guiding the collection of further data to assess the degree of fit or match to the clinical situation. Other work (Elstein et al 1978, Barrows et al 1978) has suggested that physicians develop preliminary ideas very early on in the clinical encounters as to what may be wrong with the patient in response to very few cues. Grant and Marsden (1983) also suggest that "forceful features" within the clinical information presented act as the key to an array of information in the diagnostician's memory. If this array of information is conceived as a category of clinical knowledge structured around the
prototype then it is possible to postulate a process in which forceful features in the clinical situation stimulate the retrieval of prototypical disorders. These provide a framework for searching for further clinical features in order to assess the degree to which the presenting situation matches the prototype. The activities of building a pattern from the clinical information available and pattern recognition could therefore be seen as an iterative process.

This view is supported by Eddy and Clanton (1982) who suggest that in order to compare patterns, which they describe as one of the physician's most effective mental skills, he must first "recast" the problem. They therefore describe the first step in the diagnostic process as the aggregation of groups of findings into patterns. Physicians attempt to reduce the size of the problem solving task by grouping elementary findings, a single piece of information about the case, into sets known as aggregate findings. For example, a clinician may combine the four elementary findings of extreme polyuria, nocturia, polydipsia, and a urinary specific gravity below 1.003 into the aggregate finding of diabetes insipidus. The authors suggest, however, that aggregation differs from diagnosis in a number of ways:

- few elementary findings are involved
- they are closely related and easily identified as a single group
- they can be analysed apart from the rest of the patient's problems
- aggregates involve a clinical pattern for which there is a definite and unambiguous explanation.

Thus the recognition of a pattern of findings is sufficient for aggregation whereas full diagnosis frequently requires more extensive reasoning (Eddy and Clanton 1982).
The views concerning pattern recognition as a means of retrieving knowledge and thus solving clinical problems have been reviewed. It is recognised that some pattern building may be required in order for a pattern recognition to occur. Although pattern recognition has been established as an extremely rapid process, it is dependent on the clinicians ability to recognise salient, pivotal or forceful features amongst the array of clinical information he is presented with.

4.3.2 Analagous reasoning

The previous section described how knowledge is retrieved when the clinician encounters a clinical problem that corresponds closely to situations he has met before. How then do clinicians attempt to deal with new or novel problems? What role does their prior knowledge play in this context?

Analogical thinking provides an explanation for how physicians apply knowledge from one situation to another. Accounts of analogical thinking are closely related to schema theory, described earlier, and are based on the idea that the individual recognises the similarities between two apparently dissimilar problems and is therefore able to apply the solution of the known problem to the novel situation.

Jorgensen (1980) defines an analogy as "a resemblance in some particular between things otherwise unlike, i.e. a similarity." Analogies can therefore be used to make the unfamiliar seem familiar by relating it to prior knowledge. This is a strategy employed in education so that students may be taught that the heart resembles a pump and the atom a miniature solar system (Gick and Holyoak 1983). This approach is
dependent on the ability of the human mind to reason by analogy and it is this ability which is used to solve new problems in terms of old ones.

Analogical thinking involves the transfer of knowledge from one situation to another by a process of mapping, finding a set of one-to-one correspondences, which may be incomplete, between aspects of one body of information and aspects of another. The concept of analogy and the concept of “shema” are closely related and consist of an organised system of relations. For example, Gick and Holyoak (1983) suggest that the two problems in their study may be organised into an initial state, which includes goals, available resources and constraints, a solution plan and an actual or anticipated outcome.

In the process of analogical reasoning, Gick and Holyoak (1980) suggest that the individual abstracts the relational structure which a particular set of instances have in common. In this way a schema for solving this type of problem is developed. New problems in this class are then mapped directly with the problem schema. Gick and Holyoak (1980) therefore suggest that there are three activities involved in analogous reasoning:

i) comparing one instance to another

ii) deriving a schema for a class of instances

iii) comparing an instance to a general schema. Table 4.1 shows how the two convergence problems described in their study and the problem schema correspond.
Table 4.1 The development of a Convergence Problem Schemata (Gick and Holyoak 1983)

<table>
<thead>
<tr>
<th>Relational structures</th>
<th>Military Problem</th>
<th>Radiation Problem</th>
<th>Convergence Problem Schema</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial State:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Goal</strong></td>
<td>Use army to capture forces</td>
<td>Use rays to destroy tumour</td>
<td>Use force to overcome a central target</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td>Sufficiently large army</td>
<td>Sufficiently powerful rays</td>
<td>Sufficiently great force</td>
</tr>
<tr>
<td><strong>Constraint</strong></td>
<td>Unable to send entire army along one road</td>
<td>Unable to administer high intensity rays from one direction</td>
<td>Unable to apply full force along one path</td>
</tr>
<tr>
<td><strong>Solution Plan</strong></td>
<td>Send small groups along multiple roads simultaneously</td>
<td>Administer low intensity rays from multiple directions simultaneously</td>
<td>Apply weak forces along multiple paths simultaneously</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>Fortress captured by army</td>
<td>Tumour destroyed by rays</td>
<td>Central target overcome by force</td>
</tr>
</tbody>
</table>

The common relations in the two problems are mapped and these identities are abstracted to construct a problem schema. The process of schema induction therefore involves deleting the differences between the analogues while preserving their commonalties.

There are two main difficulties in relation to analogical reasoning: one is about noticing a potential analogy and the other, closely related, problem is that of how analogies are accessed in memory. Noticing an analogy is difficult because it will frequently be encoded in a different context from that of the presenting problem. The challenge is to make the connection between two bodies of information from disparate semantic contexts.
Accessing an analogy involves the process of retrieving it from long term memory. The development of a problem schema is very important here. Gick and Holyoak (1983) identify two ways in which analagous problem solving may occur. The new problem may be mapped directly onto a prior analogue to generate the analagous solution. This is referred to as "reasoning from an analogue". (A problem schema may be induced as a result of this process). Secondly, an independent schema may already have been produced and been stored in memory. The new problem is therefore mapped directly with the schema in order to arrive at a solution. This is referred to as "reasoning from a schema."

The advantage to reasoning from a schema relates to the way in which it enhances the retrieval of a useful analogy. Gick and Holyoak's (1983) study shows that without an appropriate schema it is relatively difficult to retrieve a prior analogue when presented with a new problem. Tversky's (1977) analysis of features of similarity provides the basis for this and suggests that an analogue will be more similar to its problem schema than another analogue since the schema contains all the aspects common to the two analogues and none of the disparities. An independent schema is therefore important for facilitating the noticing and retrieval of an analogue.

Thus, if a presenting situation can be related to prior knowledge, which results in its relevant aspects being encoded at an abstract level, it has the potential to be related to a new analogue from a different domain in the future. The previous section established that experts tend to encode problems at a relatively abstract level (Chi, Feltovich and Glaser 1981). It is therefore suggested that expert knowledge of one domain should enable analogical transfer to another (Gick and Holyoak 1983).
In summary, the process of analogous reasoning provides a mechanism for clinicians to retrieve knowledge from one domain in order to be able to solve a problem in another. Although this appears to contradict earlier findings relating to domain specificity in problem solving, the way in which experts organise their knowledge is considered to facilitate transfer of problem solutions from one domain to another. The organisation of knowledge, in terms of problems schema based on abstract principles, is seen as essential to the ability to retrieve and apply it to the new situation. The success of analogous reasoning depends on the individual’s ability to detect the similarity between two problems and this is dependent on the extent to which their knowledge is organised on abstract principles.

4.3.3 Intuitive reasoning

Another type of reasoning which appears to be underpinned by a process of pattern recognition is that of intuitive reasoning. The concept of intuition has been defined in various ways by different authors; Benner and Tanner (1987) define it as “understanding without a rationale” whilst Gerrity (1987) defines it as “a perception of possibilities, meanings and relationships by way of insight”. The immediacy of intuition and the fact that it bypasses conscious reasoning processes is captured by Schraeder and Fischer’s (1987) definition: “the immediate knowing of something without the conscious use of reason.” Finally Rew (1988) identifies three defining characteristics of intuition which capture all of these points: Intuition means knowing a fact or truth as a whole; having immediate possession of that knowledge; and having knowledge which is independent of linear reasoning processes. The idea of perceiving the problem situation as a whole is also an important one. Pyles and Stern
(1983) identified what they described as a “nursing gestalt”, a matrix which linked together the nurse’s knowledge, past experience, patient cues and gut feelings. Gut feelings were recognition by the nurse that the patient was “falling out of the pattern”. In other words there was a discrepancy between what the nurse observed in the clinical situation and what she expected to see, as determined by her prior knowledge and experience.

Because intuition was seen as “process whereby the nurse knows something about a patient that cannot be verbalised, that is verbalised with difficulty, or for which the source of knowledge cannot be determined” (Young 1987), it was considered by some to be unprofessional with intuitive judgements being compared unfavourably with “rational,” “scientific” decision making (Easen and Wicockson 1996). However, Hammond’s (1980) Cognitive Continuum Theory describes intuition as being at one end of a continuum with analysis at the other. Intuitive thought involves rapid, unconscious data processing that combines data by “averaging” it whilst analytical thought is slow, conscious and consistent. Hammond (1980) suggests that it is the characteristics of the task that will determine the type of cognition employed. These characteristics include the complexity of the task, the ambiguity of the content of the problem task, and the form of task presentation. The ability of a task feature to induce a particular mode of cognition will also be dependent on the subject’s knowledge and experience. On the basis of the results of a study by Hamm, Hammond, and Grassia (1985), Hammond suggests that the greater the subjects knowledge the more likely he is to think analytically. This view contrasts with others who regard intuitive reasoning as a characteristic of the knowledgeable and expert physician. Dreyfus and Dreyfus’ (1986) theory of expert cognition describes five stages that one must
progress through: novice, advanced beginner, competent, proficient, and expert. With increasing expertise the individual moves from analysis to intuition as the dominant cognitive mode. Young (1987) also claims that intuition is grounded in both knowledge and experience whilst Eraut (1994) and Benner (1984) suggest that a sound knowledge base, experience and a holistic view of the situation are required for intuitive reasoning to occur.

With regard to the rationality of an intuitive decision, Jung (1991) makes a useful distinction between the process and content of intuition. Whilst the process of intuitive reasoning may not be a conscious reasoning process, so that intuitive decisions have the characteristic of being “given” rather than derived or produced, the intuition can be broken down retrospectively into it constituent parts and “brought into harmony with the laws of reason” (Jung 1991). Thus as Easen and Wilcockson (1996) suggest whilst intuition may be seen as an irrational process the intuitive decision is not, in itself, irrational. This point is perhaps best illustrated by reference to an account from an expert nurse in Benner’s (1982) study.

“I walked up to this patient’s bed and said “My God, this patient is having a pulmonary embolus”..... and it turned out that he was..... Later the physician said “What made you think he had a pulmonary embolus?” and I had to stop then and go over the facts:

• He had nasal flaring
• His knee caps were mottled
• He had tachycardia
• He had a right bundle branch block that went transitorially across the screen
• He had tachypnea
- He had circumoral cyanosis

But I just went click, click, click: pulmonary embolus.”

This subject is describing the almost instant recognition of the patient’s state on the basis of a few critical cues. Because experts perceive the problem in a holistic way it is difficult for them to identify immediately the particular factors which led them to their conclusion. However, this does not mean that there is no rational basis for their decision.

Intuitive reasoning, then, describes a process which enables the nub of a problem to be grasped in a spontaneous, speedy and effortless way without any conscious reasoning. For intuitive reasoning to occur the individual needs to have a sound, relevant knowledge base and the ability to recognise patterns in the presenting problem (Easen and Wilcockson 1996). Pattern recognition is based on past experience which enables the individual to develop an organised knowledge base to facilitate the linking of past events to the presenting situation. Accounts of intuitive reasoning thus provide another example of how experts retrieve information, albeit unconsciously, from a highly refined knowledge base and apply it in problem solving tasks.

4.3.4 The Recognition Primed Decision Model

In the previous chapter the work of the naturalistic decision movement (NDM) was introduced. The focus of this research is how decisions are made in complex, real world environments. The dominant naturalistic decision making theory is described by the Recognition Primed Decision (RPD) model postulated by Klein (1993). Rapid
recognition of the type of situation that pertains, and therefore the action required, is the main feature of this model. Thus within this approach there is an emphasis on the decision to act as well as the judgement about what state pertains within the problem environment.

Klein’s (1993) original work involved a study of fireground commanders who he found were acting and reacting to the problem situation on the basis of prior experience. They generated, monitored and modified plans in response to the changing demands of the situation.

The fireground commanders relied on their ability to firstly recognise and secondly, appropriately classify a situation. Once they knew it was “that” type of case they knew what the typical response to the situation should be. There are obvious parallels here with the process of pattern recognition and schema theory described earlier.

Klein and Crandall (1995) suggest that the RPD model explains how people under time pressure can make decisions without having to compare the various options. It involves the combination of two processes: situation assessment and mental simulation. Kaempf et al (1996) use the term situation awareness and suggest that it refers to a state of knowledge that includes three components:

- the perception of elements within the environment
- the comprehension of their meaning
- the understanding of their anticipated status in the near future

There are clear parallels here with work previously reviewed which showed that clinicians detect the salient, pivotal or forceful features from the array of data in the
clinical environment. These features convey some special meaning or significance and trigger the retrieval of relevant knowledge structures in long term memory.

According to the RPD model once a situation is assessed a feasible course of action is generated. The individual uses mental simulation to evaluate this course of action in that particular environment. This enables him to develop expectancies about how the situation will evolve and facilitates the detection of specific obstacles to the course of action selected. The features of the RPD model can thus be described as follows (Klein and Crandall 1995):

- Situational recognition which allows the decision maker to classify the task as familiar versus unfamiliar or atypical.
- The recognition classified as familiar carries with it recognition of the following types of information: plausible goals, cues to monitor, expectancies about the unfolding situation and typical reactions.
- Options for courses of actions are generated serially, with a very typical course of action as the first one considered.
- Option evaluation is also performed serially, using mental simulation to test the adequacy of the option, identify weaknesses of the option and find ways to overcome them.
- Skilled decision makers can respond quickly by using experience to identify a plausible course of action as the first one considered.
- Under time pressure they can be poised to act while evaluating a promising course of action.

The model contains many of the ideas previously discussed in relation to problem solving and the application of knowledge. Firstly there is the idea of recognition of a
situation which is suggestive of the idea of pattern recognition described earlier. Indeed Keampf et al (1986) found that feature matching was the dominant strategy used in developing situation awareness. In their study of the command and control decisions made by the anti-air warfare (AAW) team on a US naval cruiser, they were able to identify a clear and limited set of features which were considered in relation to aircraft in the vicinity. For example, the aircraft has taken off from hostile territory, it emits identification signals consistent with fighter aircraft, it ignores radio warnings. It is suggested that each of these features has meaning for AAW personnel and that they match features observed in the environment with interpretations they have previously learned to assign to such patterns of cues. This enables them to derive some understanding of the situation that is emerging around them. Within the RPD model, once a situation has been recognised there is a subsequent retrieval of a particular knowledge structure like the mental models, schema and illness scripts described earlier. Another important aspect in common with concepts already reviewed, is the idea that this knowledge structure includes expectations about how a situation will develop which enables the individual to predict and plan for future events.

It is acknowledged that the mental simulation described in this model is closely linked to the concept of mental models, but that the latter is broader as it is the representation in memory of a whole task or problem domain (Klein and Crandall 1995). Mental simulation can be seen as a subset of a mental model as it includes only the information people use when they construct and evaluate courses of action.
A further similarity between this model and other accounts of problem solving is the hypothesis that the skill in constructing a mental simulation lies in selecting a few components at an appropriate level of abstraction. The work of Chi et al. (1981) has established that experts store and organise their knowledge at a relatively abstract level, whilst Gick and Holyoak (1993) suggest that the ability to abstract the relational structures of different problems is important for the induction of problem schema.

The importance of experience as a basis for expertise is also acknowledged within the RPD model and expert performance is identified as both rapid and incisive. Indeed both Flin et al. (1986) and Klein (1993) suggest that recognition primed decision making is a skill that develops naturally as a function of expertise and therefore is not a technique that can be taught directly. However, the need to train problem solvers in situation assessment, and in particular to teach the recognition of critical situational cues, is identified.

The RPD model has been applied and tested in a variety of task domains such as battle planning, critical care nursing, corporate information management, and aircrew co-ordination. These studies have confirmed the importance of mental simulation as a feature of the model. It has been found to serve a number of essential functions including evaluating courses of action, improving courses of action and generating expectancies (Klein 1995). Thus mental simulation is important for judging what state pertains and revising this judgement as the situation changes as well as evaluating proposed actions and predicting future events.
In summary, the RPD model has been developed to describe decision making in naturalistic environments. The features of this type of decision making were identified in chapter two and the case for considering clinical decision making as an example of naturalistic decision making was made.

The elements of the model are entirely consistent with the literature reviewed thus far. An important feature is the idea that has emerged throughout this chapter that it is how knowledge is stored and organised that determines its accessibility. With experience an individual's knowledge structures become increasingly refined and based on abstract principles. Thus skilled or expert performance can be largely accounted for by recognition of critical cues or a pattern which trigger rapid retrieval of a well organised knowledge structure. This structure is used both for judging the nature of the presenting situation and for generating possible actions in response to it. Therefore, in the clinical context an expert's knowledge structure will embrace both the diagnosis and treatment aspects of the clinical task.

Throughout this chapter much reference has been made to expertise and how expert performance is distinguished from that of novices. The next section in the chapter summarises the characteristics of expert performance and reviews the underlying mechanisms for these characteristics.

### 4.4 THE NATURE OF EXPERTISE

A useful approach to summarising the literature reviewed is to consider the characteristics of expert clinical reasoning. Glaser and Chi (1988) identify seven knowledge and cognitive dimension of expertise:
1. **Experts excel mainly in their own domains**

   This feature of expertise is demonstrated by the case specificity of clinical reasoning. Repeated exposure to similar clinical problems over time enables the expert to develop a well organised body of knowledge in relation to a particular clinical speciality.

2. **Experts perceive large meaningful patterns**

   Again this feature relates to the advanced levels of organisation of knowledge that experts have, enabling them to see a total picture rather than undertaking say, a symptom by symptom analysis of a clinical problem. The previous section reviewed various accounts of how experts organise their knowledge (mental models, schema, and illness scripts) to facilitate pattern recognition.

   Support for a pattern recognition view of knowledge retrieval comes from a variety of sources (Elstein (1995), Cox (1988) Bordage and Lemieux (1991) and Lemieux and Bordage (1992)). Outside the field of medicine Charness (1978) identified the possession of a large vocabulary of recognisable patterns which are associated with appropriate actions, as essential for skilled problem solving in chess. In anti-air warfare, feature matching has been found to be the dominant strategy used by personnel to assess the confronting situation (Kaempf et al 1996).

   This critical difference in the organisation of their knowledge and therefore their perception of problems leads to further difference in the reasoning of expert and novices. As described earlier, experts typically take a “working forward” or “knowledge development” approach (Larkin et al 1980). Novices, however, typically
take a “backward working” approach or means end analysis. Patel and Groen (1986) suggest that the use of backward chaining is dependent on two features: the matching of the task to expertise and the nature of the task itself. Thus experts may use backward reasoning strategies, such as hypothetico-deductive reasoning, in domains where they do not have a well developed knowledge base (and are therefore not expert) and where the task is complex.

3. **Experts are fast: they are faster than novices...and they quickly solve problems with little error.**

Over time the expert has developed a number of problem representations which enable him to accurately and rapidly identify the problem solution given the presence of certain features or conditions as part of the presenting problem. The speed of experts is largely accounted for by the fact that they can rapidly retrieve information from their memory and do not have to search their knowledge base extensively. This characteristic allows cognitive capacity to be available for other cognitive tasks.

The RPD model (Klein et al 1993) describes naturalistic decision making in which time constraint is a critical factor. The model emphasises the need for the rapid appraisal of a situation (situation awareness) and a swift evaluation of action required in response to it through mental simulation. In the same way Benner (1982) emphasises the value of perceptual awareness in the expert nurse. “Skilled knowledge” as she describes it, means that the nurse does not have to reflect consciously in order to identify the relevant elements, or aspects, of the situation. This view is supported by the account of an expert nurse in her study, described in section 4.3.3.
Baumann and Bourbonnais (1982) also found evidence of rapid decision making by nurses in a critical care setting. Subjects again identified knowledge and experience as the two most important factors influencing rapid decision making. The authors found that nurses could make rapid, accurate decisions without a complete data base, suggesting that a few key features in the presenting situation were enough to trigger the retrieval of appropriate knowledge.

4. **Experts have superior short-term and long-term memory.**

Although more experienced clinicians recall less information than novices (Patel and Groen 1991), the explanation for this is that more experienced clinicians filter out information that is not relevant to the diagnostic task. The superiority of the expert’s memory therefore relates more to qualitative than quantitative attributes. It is the way in which experts encode, store and retrieve knowledge from memory that is the basis for their expertise (Gale and Marsden 1988).

5. **Experts see and represent a problem at a deeper (more principled) level than novices; novices tend to represent a problem at a superficial level.**

This characteristic again relates to the experts’ organisation of knowledge. In particular the work of Lemieux and Bordage (1992) which has already been discussed suggested that experts have developed more diversified and abstract sets of semantic relations, which enables them to make links between different clinical features or aspects of the presenting problem. Chi et al (1981) also identified that experts organise their knowledge at a more abstract level. Furthermore abstraction has been found to be important in facilitating analogous reasoning (Gick and Holyoak 1983) and constructing mental simulations as described by the RPD model (Klein 1995).
6. **Experts spend a great deal of time analysing a problem qualitatively.**

Glaser and Chi (1988) describe how experts attempt to gain a global understanding of a problem at the start of the problem solving task whereas novices tend to rush to apply strategies in search of a solution. Experts tend to invest time initially in a low detail qualitative analysis of the problem which serves as a basis for planning (Simon and Simon 1978, Larkin et al 1980). This approach may account for experts' success with ill-defined problems where clarification of the problem is needed before work on its solution can commence.

7. **Experts have strong self monitoring skills**

Glaser and Chi (1988) cite evidence that experts are more aware of when they have made errors and when they need to review their problem solutions. Smith (1984) also found that his subjects made a series of "checks" on the correctness of their solution as they worked. Successful subjects understood that the task required a particular strategy and that certain checks along the way could be used to gauge the accuracy of their work. Hassebrock et al (1993b) propose that metacognition (self-monitoring) is needed to plan, control and evaluate the knowledge and strategies used in clinical reasoning (Higgs and Jones 1995). It is suggested that metacognition is an important strategy for handling the variabilities, uncertainties, cognitive limitations and ambiguities that characterise clinical decision making. Indeed Swanson (1990) asserts that metacognition provides an interface between general problem solving skills and domain specific knowledge.

Flavell (1979) looked at the processes involved in metacognition and found them to consist of: realising that important problem solving information is missing or ambiguous, recognising that problem solving will be difficult, planning strategies to
manage the clinical problem, being aware that reasoning errors have been committed, evaluating the effectiveness of reasoning strategies, and allocating cognitive resources. A model of metacognition was developed by Flavell (1979) which included three categories of metacognitive knowledge: person knowledge (the capacity and limitation of the individual as a cognitive processor), task knowledge (awareness of available task data, it's relevance etc.), and strategy knowledge (awareness of plans and strategies for goal achievement). Hassebrock et al (1993b) found that combinations of all three knowledge types were involved in the metacognitive ability of physicians. They recommended the teaching of metacognition to enhance medical problem solving.

In summary this section has reviewed the characteristics of experts and related this to the work already presented on the organisation and retrieval of knowledge. The key theme is that experience provides the individual with repeated exposure of the same class of problems which enables the development of a well organised body of knowledge at an abstract level. Because of the nature of its organisation, knowledge can be retrieved rapidly and accurately in response to a few key cues in the problem situation. The importance of the link between knowledge and reasoning skills will be discussed in the next section.

4.5 KNOWLEDGE – REASONING INTEGRATION

The literature reviewed thus far has shown that clinical reasoning or problem solving is not a separate skill that can be developed and taught independently of a body of highly organised clinical knowledge. Subsequent research has produced increasing evidence of the importance of domain-specific knowledge and an organised knowledge base. However, the emerging view is that it is the interplay between
knowledge and reasoning skills that provides the best explanation of the clinical reasoning process. Thus Higgs and Jones (1995) suggest that it is the “interaction between such knowledge and skills in reasoning which lies at the heart of clinical expertise.” Both highly organised, domain-specific knowledge and skills in cognition are considered essential for effective problem solving.

Bordage and Grant (1990) discuss the importance of “flexibility of thinking” during the clinical interview, which refers to “the use of a variety of thinking means or processes that can be applied during the diagnostic process.” They suggest that this flexibility is shown by two modes of enquiry during the clinical interview: the deterministic and responsive mode. In the deterministic mode the physician asks questions based on memorised knowledge about the interpretation in mind. In the responsive mode the physician temporarily suspends the deterministic enquiry and immediately follows up new information proffered by the patient. During the course of the clinical encounter a number of forceful features arise which create shifts in the clinicians’s thinking by triggering the retrieval of relevant knowledge stored in memory. Thus the combination of organised knowledge and appropriate reasoning strategies is seen as crucial to diagnostic success.

In his study of problem solving by doctors in relation to congenital heart disease, Hassesbrock (1992) describes a theory of problem solving which is a “melding” of domain reasoning (diagnostic medical problem solving in his work), domain knowledge (diagnostic knowledge of congenital heart disease) and a theory describing the underlying architecture of the human mind (information processing theory). This is a useful way of considering the different strands of problem solving that must be woven together in order to understand the whole process. Hassesbrock (1992) and
Narayan and Corcoran-Perry (1997) developed a representation of an individual’s line of reasoning (LOR) to describe how knowledge and cognitive processes are combined during problem solving. Narayan and Corcoran-Perry (1997) argue that a LOR provides a more complete representation than models which rely on either knowledge elicitation or identification of cognitive processes alone. They suggest that a LOR is powerful because it combines knowledge and cognitive processes in a single representation of how a person uses knowledge in the process of reasoning about a particular situation. In the second study both the knowledge utilised by District Nurses and the reasoning strategies they employ will be examined.

4.6 THE CONTENT OF DOMAIN SPECIFIC KNOWLEDGE

So far the literature reviewed in this chapter has related to how knowledge is organised and retrieved. However, the content of knowledge is clearly important for successful clinical problem solving. The findings of the first study suggested that nurses had domain specific knowledge that led them to expect certain clinical features on the basis of the information available. From this it was concluded that the content of nursing knowledge was important in problem solving and it was suggested that domain specific knowledge could be examined by investigating what phenomena nurses choose to attend to.

Feinstein (1995) suggests that enormous efforts have been made in recent years to improve certain aspects of medical information. Amongst these he identifies demographic data, which refers to such entities as race, age and gender; therapeutic-agent data, which refers to drug treatment, surgical procedures and other types of treatment; administrative data, which refers to factors such as hospital location and
paraclinical data, which refers to information derived from laboratory tests and other clinical investigations. He argues, however, that a set of principles and strategies has not yet emerged from the clinical data that is a result of clinicians' work in directly examining patients and reasoning with the information they obtain in this way. He proposes the development of a domain, which he refers to as clinimetrics, or the measurement of clinical phenomena. Feinstein (1983) describes these phenomena as the distinctively clinical and personal phenomena relating to personal care or the human clinical phenomena that are observed, judged and decided during clinical examinations. The phenomena that Feinstein (1995) describes appear to depict the experience of illness for the patient. Thus he includes as clinical phenomena symptoms and other manifestations of disease, the associated disabilities and other functional impairments, and the reactions of the patient, family and clinician to these phenomena. Specific examples include phenomena such as pain, insomnia, anxiety, depression, and the impaired mobility of Parkinson's disease. He also describes clinical phenomena in terms of constructs such as the rate of progression of illness, severity of co-morbidity, reasons for medical decisions and problems in maintaining therapy (Feinstein 1993). This latter group of phenomena appear to represent the nature of the judgements that a clinician might make having considered clinical data such as symptoms, functional impairment and so on. These phenomena have some similarities with the "semantic axes" described by Bordate and Lemieux (1991) and referred to earlier. These representations include categorisations of similar and contrasting information in relation to a problem such a pain (local versus general, intermittent versus continuous) or the overall condition of the patient (stable versus unstable). They therefore represent more abstract levels of representing the clinical data that has been attended to.
Feinstein (1995) suggests that clinical data act as harbingers of prognosis and determinants of therapy. Thus clinical information assists in determining the severity of illness, which is used to judge prognosis, whilst changes in symptoms, such as pain, lead to alterations in therapeutic intervention. If Feinstein's (1995) hypothesis is accepted then the phenomena to which nurses attend during the course of an assessment will have implications for the intervention they plan and the predictions they make about the state of the patient.

4.7 SUMMARY

The review of the literature has traced the development of thinking in relation to clinical reasoning. Early views, described in chapter one were that clinical reasoning was based on a common problem solving process. Evidence of case specificity in clinical reasoning cast doubt on this and the importance of domain specific knowledge was recognised. Work on expertise in clinical problem solving showed that the organisation, and thus accessibility, of this knowledge was critical to diagnostic success. The importance of metacognition as a means of clinicians monitoring their own problem solving performance was discussed and the emerging view that it is the integration of knowledge and appropriate reasoning strategies that is important for success in problem solving was explored. Figure 4.3 on page 172 shows how the organisation of their knowledge by experts and consequent ability to retrieve and apply this knowledge provides the basis for expertise.

In addition to the organisation and utilisation of knowledge, the content of clinical knowledge was considered. This was described in terms of clinical phenomena (Feinstein 1995) that provide a basis for making prognostic judgements and deciding
on therapeutic intervention. In summary, the literature reviewed here suggests that the knowledge used by nurses, as well as their reasoning processes, should be the focus of research if clinical problem solving in nursing is to be fully understood. The second study, reported in chapters five and six, therefore aims to identify nurses' reasoning processes and establish the content and structure of the knowledge utilised by district nurses during problem solving. Finally the way in which nurses structure the assessment task will be examined.

**Figure 4.3 The Components of Skilled Clinical Reasoning**

**ORGANISATION OF KNOWLEDGE**

Mental models, Schema and illness
Scripts developed and modified through experiences

**UTILISATION OF KNOWLEDGE**

Pattern Recognition
Analoguous Reasoning
Intuitive Reasoning
RPD model

**THE NATURE OF EXPERTISE**

Experts success is domain specific
Experts perceive large meaningful patterns
Experts solve problems rapidly
Experts have superior memories
Experts represent the problem at a more principled level
Experts sped time analysing a problem qualitatively
Experts have strong self monitoring skills
CHAPTER FIVE

AN INVESTIGATION INTO THE CONTENT AND STRUCTURE OF THE KNOWLEDGE USED BY DISTRICT NURSES DURING ASSESSMENT

5.0 INTRODUCTION

The previous chapter reviewed studies which demonstrate the importance of an individual’s knowledge base in problem solving. A well-organised knowledge base enables the problem solver to identify key features in the presenting situation and rapidly retrieve a body of knowledge, which will include information on what situation might pertain and how to respond to it. It is therefore important to identify both the content and the organisation of knowledge used by District Nurses during problem solving, issues which the first study did not address. In the study described in chapters five and six the content of District Nursing knowledge will be examined in terms of the phenomena subjects attend to or the topics they cover. Evidence relating to the organisation of knowledge will be sought by identifying how subjects structure the assessment task, examining which topics they raise and in what order.

As it is equally important to understand the cognitive strategies nurses use to work through the problem solving task these will also be examined.

The theoretical framework for this study is derived from Information Processing Theory, which was described in Chapter One. According to Information Processing Theory the problem solving task starts with the presenting situation; the problem state, and ends when a solution is reached; the goal state. The problem solver does not know initially how to transform the problem state in to the goal state. By applying
one or more operators to transform the problem state into an intermediate state, or several intermediate states, the goal state is achieved. An operator is defined by Montgomery and Svenson (1989) as an activity to alter states. Thus a sequence of operators is applied during the problem solving task. The problem solving states and the operators comprise the problem space and the operators can be viewed as paths moving from one state to another. Montgomery and Svenson (1989) therefore suggest that the problem solving task can be understood as a journey through the problem space.

To understand problem solving within District Nursing, consideration must be given to both the knowledge and the cognitive operators used to move the nurse through the problem space. In chapter four Hassebrock’s (1992) theory of problem solving which combines domain reasoning, domain knowledge and a theory describing the underlying architecture of the human mind was reviewed. In the context of district nursing assessment, domain reasoning is the way in which nurses undertake problem solving in order to identify the patient’s nursing needs and address them (diagnosis and treatment), domain knowledge encompasses diagnostic and treatment knowledge in relation to the nursing problems of patients in the community and these dimension are examined within the context of information processing theory.

The study reported in this chapter investigates the cognitive operators that district nurses use and the knowledge that is applied during the problem solving task. The focus of the study is therefore the content of District Nursing knowledge; it’s structure or the way in which knowledge is organised internally, and the processes, which are utilised during the problem solving task.
The findings of the investigation into the types of decisions made by District nurses and the cognitive strategies they use, reported in chapter three, indicated that this was not a menu driven process and that nurses had some internal knowledge structure that was guiding their assessment of patients. Where nurses are given a non-specific referral they have to impose some structure on the assessment task in order to establish the patient’s nursing needs. It was postulated that this structuring would be based on the nurses’ views of which phenomena in the clinical situation are relevant and important. Examining the focus of nurses’ attention during the assessment visit will help to illuminate the domain of nursing and its underpinning knowledge base. It will provide empirical evidence for the clinical phenomena to which nurses attend. This study therefore investigates the content of District Nurse’s knowledge in terms of the phenomena attended to and topics covered. The structure of assessment visits is also considered to see how nurses organise the assessment task, particularly when the nursing problem is not “given” in the referral information.

5.1 AIMS OF THE STUDY

1 To describe the knowledge utilised by District Nurses in terms of the phenomena on which they focus and the topics they cover during an assessment visit.

2 To identify how nurses structure the problem solving task (i.e. the assessment visit).

3 To identify cognitive operators used by district nurses during the assessment of patients.
This chapter reports on the findings in relation to the first two aims of the study; the knowledge utilised by District Nurses and the way in which they structure the assessment task. Chapter six reports on the cognitive operators used by District Nurses and describe how subjects combine knowledge and cognitive processes during problem solving.

5.2 METHODOLOGY

The research design of the second study uses the same methodology as that of the first study described in chapter three. District Nurses were accompanied on assessment visits by the investigator who acted as a non-participant observer. The visits were tape-recorded and the tapes replayed to the District Nurse in a stimulated recall session immediately following the visit. During the recall session the District Nurse was asked to describe her thinking throughout the assessment. After the assessment visit and the recall session the tapes were transcribed to produce a visit protocol and recall protocol for each case.

The second study was conducted in a different area from that of the first study. As the investigator has moved her employment to a new area, the study was still conducted in an area where she was known in a managerial capacity. The key features of the research design are shown overleaf.
Figure 5.1 Key Features of the Research Design

**SAMPLE**
Chosen on the basis of their expertise

**SETTING**
Naturalistic – high ecological validity

**DATA**
Verbal protocols; Assessment visit Stimulated recall session

**TASK ANALYSIS**
Characteristics of the subject Clinical materials available Specific or non-specific referral

**METHODS**
Process Tracing: Observation Stimulated recall

**DEVELOPING A CODING FRAMEWORK**
For analysis of topics and phenomena: categories derived from themes emerging from the data
For cognitive strategies: some predetermined categories others derived from the data.

**VALIDITY AND RELIABILITY**
Subjects’ estimation of the similarity of the study visits to their usual performance.
Assessment of data against the relevance, consistency and memory criteria.
Inter-rater reliability measured by percentage agreement and Kappa value.
5.2.1 The Sample

The sample was recruited by inviting nurses who were interested in participating in the study to volunteer. The nurses who were managed directly by the investigator were not approached to be part of the study. A sample of five was recruited. When nurses received a referral for a new patient, they contacted the investigator and made arrangements to undertake the assessment visit accompanied by her. They also contacted the patient to explain that the investigator would be coming and that the visit would be tape-recorded. At the beginning of each visit the patient’s consent to participate in the study was confirmed.

The criteria for inclusion in the study were the same as for the first study:

- The nurse had to be a District Nursing Sister/Charge Nurse.
- The nurse had to give written consent to being part of the study.
- The patient’s consent had to be obtained prior to commencing the visit.

Nurses were again asked to exercise their professional judgement about excluding referrals from the study where it would be inappropriate to ask patients to be part of the study, such as those who were terminally ill.

The ethical dilemma of potentially identifying poor practice was addressed, as before, by agreeing that generalised feedback would be given to the appropriate nurse managers.
On completion of the visit and stimulated recall session the nurse was asked to rate how typical her performance had been of her usual practice.

5.2.2 Task Characteristics

An analysis of the characteristics of the task was completed for each case (see Table 5.1). The investigator obtained the data necessary for the task analysis when she met up with the nurse just prior to the assessment visit. The data collected related to the characteristics of the nurse and the clinical materials she had relating to the patient to be assessed. The clinical materials included the referral information, previous knowledge of the patient, or information from the medical notes. In this study a distinction was made between those referrals which were specific and those which were non-specific in relation to the nursing intervention required. For example, in case one the nurse was simply asked to “assess” a patient who had had a diagnosis of Motor Neurone Disease for two years, whilst in case two the nurse was asked to “dress a blister, ?burn”. One of the aims of the study was to identify whether nurses approached specific and non-specific visits in a different way and so information about the nature of the referral was incorporated into the analysis of the task characteristics.
Table 5.1 Task Characteristics for each Case

<table>
<thead>
<tr>
<th>CASE</th>
<th>NURSE CHARACTERISTICS</th>
<th>CLINICAL MATTERS</th>
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5.3 **DATA ANALYSIS**

5.3.1 **Content Analysis**

As described in the previous section two verbal protocols were obtained for each of the five cases: a visit protocol and a recall protocol. A process of content analysis was used to analyse, systematically, the data obtained in the verbal protocols. The purpose of the analysis was to determine the topics nurses covered and the cognitive operators they used.

As noted in chapter two, the first step in content analysis is to identify the basic unit of text, which is to be examined and assigned to a category (Weber 1990). For the analysis of topics covered during the course of a visit, each protocol was divided into segments, which covered a particular subject. The length of the segments varied according to the number of verbalisations on each topic. Thus the segment for which the topic was *personal details* tended to be quite short because this only involved the exchange of factual information, whereas other segments such as those for the topic *mobility* tended to be longer as the nurse needed to establish a detailed understanding of the patient's capabilities. The unit of text used for the analysis was therefore defined as all verbalisations based on the same topic. Once all the segmented protocols had been analysed by assigning data to one of the topic categories the reliability achieved was assessed (see section 5.4).

On completion of the content analysis a list of topics covered by the nurse during the course of her assessment was produced. This provided a basis for comparing the content and range of topics covered across all the cases. Next the topics covered and
the order in which they occurred were examined to see whether there was a difference in the way in which nurses structured visits, depending on whether they had received a specific or non-specific referral.

5.3.2 Analysis of topics covered

It can be argued that the goal of nursing assessment is not just to describe the state of the patient but also to ascertain what is required in terms of nursing action. The nurse seeks to refine her understanding of the patient’s condition as a basis for planning nursing intervention. Baron (1994) argues that the goal of any cognitive task determines what evidence is sought and how it used. Therefore the overall goal of the nursing assessment will influence what information the nurse collects, which clinical phenomena she attends to and what subjects or topics she covers as part of her assessment. In the course of completing a task, Baron (1994) argues that the individual often has sub goals. During the assessment process nurses cover a number of discrete topics each of which adds to the overall picture of the patient’s condition and therefore the care they require. The structuring of the assessment process into a number of topics can therefore be seen as breaking down the task into a series of sub goals, which contribute to the achievement of the overall goal.

Topics can be initiated by either the nurse or the patient and the analysis of topics covered included who initiated a new topic and the identification of the verbalisation that introduced the topic. This verbalisation is referred to as the initiator. It was considered important to identify who introduced a topic, as this data will contribute to an assessment of the flexibility in the nurse’s thinking. Flexibility in thinking as described by Bordage, Grant and Marsden (1990) refers to a variety of thinking
processes that can be applied during the diagnostic task and is demonstrated by the use of both the deterministic and responsive modes of enquiry. In the deterministic mode the clinician asks questions based on the knowledge he has stored in memory. In the responsive mode he temporarily sets aside the deterministic mode to follow up new information proffered by the patient. Thus a subject in Bordage et al’s (1990) study stated “I could wait to check out my idea – the patient was coming out with some good stuff.” Finding that the patient gave information which was followed up by the nurse, for instance, would provide evidence of the nurse using a responsive mode of enquiry whilst establishing that the nurse introduced topics would be evidence of the deterministic mode of enquiry. The deterministic mode of enquiry is knowledge driven and is dependent on the individual having a well organised knowledge structure stored in memory. A consequence of the organisation of knowledge in memory is that it can be rapidly retrieved and applied in the presenting situation (Klein 1995, Patel and Groen 1991, Bordage et al 1990). Use of the deterministic mode would suggest, therefore, that the nurse had some internal frame of reference that was driving the collection of data or determining the clinical evidence being sought.

The analysis of topics covered across visits was undertaken to examine the extent of commonality and divergence between visits. Identifying those topics which are consistently covered in all visits will help to determine the focus and delineate the domain of nursing. However, it would be reasonable to expect some degree of variance between visits as all the patients in this study presented with different clinical problems. For example, one would anticipate that nurse subject one, visiting a patient
with Motor Neurone Disease, might cover topics not raised by nurse subject five, visiting a patient with a fractured neck of humerus, and vice versa.

An analysis of the basis of the divergence in topics covered was subsequently carried out. This was considered important in order to determine whether this divergence is the product of variance in clinical characteristics between patients or merely idiosyncratic. It is postulated that a finding that topics vary according to the clinical characteristics of the patient will provide further evidence of a knowledge driven, rather than a menu driven, search for clinical information to determine the patient’s requirements for nursing care. It is the nurse’s internal representation of the clinical problem that directs the data she collects. In the previous study verbalisations were identified which depicted a process described by Gale and Marsden (1983) as “expecting, searching for or planning to search for specific features (symptoms, signs, tests etc) of disease or treatment of disease”. This process implies that clinicians have some internal representation of the patient’s condition, which drives the search process. For example, the extracts on page 104 show that nurse subjects in study one sought information on the loss of movement in a patient who had a stroke, sought information on the impact of jaundice on a patient’s diabetes, and sought information on cardiac problems from a patient with thrombosis. The basis of variance of topics covered between visits will therefore be reviewed to determine whether variance can be explained in terms of the patient’s characteristics. If this is found to be the case it will be hypothesised that the organisation of nurses’ knowledge in memory enables them to discriminate which items of data are relevant to collect in a given situation.
5.4 VALIDITY AND RELIABILITY

5.4.1 Validity

The issues of validity and reliability relate to validity of the data obtained in the protocols and the reliability of the coding frameworks used for the content analysis. The validity of the data was assessed by the application of three criteria to the five visit and recall protocols: relevance, consistency and memory (Ericsson and Simon 1984). In the visit transcripts most of verbalisations related to gathering information to achieve the task in hand, namely identifying the patient requirements for nursing care. The protocols represented progress through a series of topics to the point where the nurse had a good enough understanding of the patient's condition to plan nursing intervention. It is suggested therefore that the verbalisations in the visit protocols met the relevance criterion as they were relevant to the problem solving task. Data from the recall protocols confirms that they were directly related to this activity. For example, the nurse subject in recall session one describes how she moved back to a relevant line of questioning after some brief social conversation with the patient and his wife during the visit:

"Yes, I felt that we had almost finished that little bit, we were having a break and I thought right, we must I mean I'm here to establish what he can do, much as I'd like to have sat there and talked to him, I mean I was there to assess what help I was going to be able to give them or what help he needed." (Subject one)

In terms of consistency, the visits followed a similar pattern to the visits described in the first study with the nurse working through a series of topics. Thus once a new topic had been introduced the verbalisations which followed were consistent with gathering further data on this topic until the nurse had a sufficiently refined
understanding of the patient's condition to plan subsequent action. The data collected in the recall sessions provided the rationale for the introduction of topics and demonstrated that verbalisations met the consistency criterion. For example, in recall session five the nurse subject describes how her discussion of sleep was consistent with her assessment of a patient with a fractured humerus:

"Because it was obvious that she was, her main concern was her arm, and sitting was difficult and extending her hand was difficult so sleeping inevitably puts the arm in a completely different position so I went immediately into sleeping as an extension of the pain." (Subject five)

Nurses showed that they remembered critical pieces of information by returning to issues raised by the patient at subsequent points in the visit. They were able to recall, verbatim, what the patient had said and frequently quoted the patient during the recall session when providing a rationale for their search for further data or a course of action. For example, in the recall session for case three the nurse subject quotes verbatim from a telephone conversation she had had with the patient to arrange the visit:

"When I phoned him he said "What are you coming for?" and I said I wanted to see if you were able to manage to get into the bath. He said "I don't like....." he said it on the phone last night." (Subject three).

In the light of the discussion above it was concluded that the data elicited during the study visits and recall sessions met the criteria necessary for inferring underlying cognitive processes and depicting problem solving undertaken by nurses during the assessment of the patient.

A further factor relating to validity was the presence of the investigator during the study visits. As in the previous study, nurse subjects were asked to assess the extent
to which their behaviour was typical of their usual practice. Four of the five nurse subjects said the study visit was typical of their usual approach, with one subject saying that the visit was typical but that she had been self conscious. Nurse subject two described the visit as typical of her usual approach but when specifically asked whether she was aware of the tape recorder during the visit indicated that she may have been self conscious:

“I was aware of it, off and on, um, I’m quite self conscious because I actually sound incredibly young on tape, and I assume that’s how I sound to people when I’m talking to them.” (Subject two).

When the other nurse subjects were asked if they were aware of the tape recorder they indicated that they were not. For example:

“No. I’m amazed.” (Recall session one)
“I didn’t notice it.” (Recall session five)

Although she described her visit as typical subject five commented that she may have cut the visit short earlier, had the investigator not been present, and completed the assessment on a subsequent visit. However, there was no evidence that this altered the style and approach that she used during study visit. Based on the findings described above the data collected in this study were judged to the valid.

5.4.2 Reliability

The reliability of the coding schedule was established using inter-rater reliability. The consistency of the coding between the researcher and an independent coder was measured on a sample of 20% of the data. The degree of agreement was calculated by
measuring the percentage agreement between the coders and by using Cohen's (1960) Kappa as described in chapter three, section 3.4.2.

In order to measure the reliability with which verbalisations from the visit protocols had been assigned to topic categories, the independent rater was asked to read the protocol and then divide it into segments which represented all the verbalisaitons on a particular topic. The result of this instruction was that some sections of protocol were segmented into more topics by one rater than the other. Thus, within the sample of data tested, there were 34 occasions when the raters segmented the protocols in the same way and their assignment of data to topic categories could be directly compared. However, there were a further 18 occasions when one of the raters identified an additional segment and assigned the data within it to a topic category. Brennan and Hays (1992) acknowledge the difficulty presented by instances of missing data (where one of the raters has found the data insufficient to make a judgement) in the calculation of inter-rater reliability. One approach is simply to discard the data where only one rater makes a judgement. However, this would not give a true picture of inter-rater agreement. Brennan and Hays (1992) suggest that another approach is to add a category to the classification scheme that represents the judges' belief that the data is insufficient to make a rating. This process helps to avoid missing judgements and preserves the number of observations from which to calculate reliability. Two statistics are therefore presented below. The first calculation of reliability (table 5.2) includes those occasions when one of the raters did not consider the data sufficient to make a judgement. The second calculation (table 5.3) indicates the reliability when both judges agree that the data can be assigned to a category.
Table 5.2 Inter-rater agreement when missing judgements are included.

<table>
<thead>
<tr>
<th>Percentage agreement</th>
<th>56%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa value</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Thus the raters show moderate agreement (Landis and Koch 1977).

The table below shows the degree of agreement on occasions when both raters considered the data adequate to assign to a topic category.

Table 5.3 Inter-rater agreement when both judges believe data can be assigned to a topic category

<table>
<thead>
<tr>
<th>Percentage agreement</th>
<th>82%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa value</td>
<td>0.81</td>
</tr>
</tbody>
</table>

From table 5.3 it can be seen that when the raters segmented the protocols in the same way their agreement on the topic category was very high. Indeed the Kappa value suggests that they achieved almost perfect agreement (Landis and Koch 1977). The results shown in table 5.2 reflect the fact that on 18 occasions one of the raters segmented the protocol to a greater degree than the other and therefore identified additional topics. It was considered that the very high level of agreement when raters considered the same segment of data mitigated the moderate agreement achieved on the adequacy of the data for categorisation. The coding schedule for topic categories was therefore judged to be reliable.
5.5 RESULTS

5.5.1 Topics covered during the assessment visits

The full list of topics identified during the five assessment visits with their definitions is included in Appendix 3. The total number of topics identified was 70. For the purposes of presentation they are grouped into eight subject areas (see table 5.4):

- The state of the patient
- Activities of daily living
- The health and care requirements of other members of the family
- Issues related to planning care
- Treatment and services
- Symptoms and illnesses
- The patient’s views and perceptions
- Patient details

The topics identified in this study are similar to the findings of other studies concerned with the scope of nursing practice (Crow et al 1996, Luker and Kenrick 1992, and Spicer 1993).
Table 5.4 Topics covered by subjects during assessment visits, according to topic area

<table>
<thead>
<tr>
<th>Topic area</th>
<th>The state of the patient</th>
<th>Activities of daily living</th>
<th>Family</th>
<th>Treatment and services</th>
<th>Symptoms and illnesses</th>
<th>Patients’ views and perceptions</th>
<th>Patient Details</th>
<th>Planning care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topics included within the topic area</td>
<td>Background to the presenting problem Activity level Patient’s current status Emotional and mental health status Skin condition Temperature Fatigue levels Condition of the patient’s legs Baseline observations Pressure areas Self image Patients progress Summary of patient’s problems Patient’s adaptation to his condition</td>
<td>Bathing / washing Hobbies / social activity Mobility Bowels Urinary Elimination Toiletting Driving / parking Employment Getting dressed Appetite Eating Fluid intake Safety Shopping Housework Smoking Alcohol intake Vision Hearing Dentition Breathing Cooking Sleeping</td>
<td>Wife’s health Wife’s family history Husband’s requirements for care Husband’s incontinence</td>
<td>Discussion of treatment / services to date Discussion of current treatment Emergency respite care Co-ordination of care Accessing the DN service Discussion of the available services Wound dressing Wheelchair Medication</td>
<td>Pain Swollen hand Dropped toe Cramps Allergies Wound Swollen ankle Indigestion Cystitis Pressure sore Bruising</td>
<td>Patient’s understanding of his condition Patient’s view of help required Patient’s understanding of treatment</td>
<td>Patient’s personal details e.g. data of birth etc. Past medical history Financial status / benefit entitlement Housing</td>
<td>Level of support from family and other sources Discussion of plan</td>
</tr>
</tbody>
</table>
5.5.2 The phenomena attended to by subjects during the assessment task

It is useful to consider the topics subjects covered at a more abstract level of representation in terms of the phenomena that District Nurses attend to. In chapter four, Feinstein’s (1995) argument for the development of “clinimetrics” or the description and measurement of clinical phenomena was reported. He suggested that phenomenon that cannot be captured by “hard” data are an important and valid part of clinical decision making. In Feinstein’s (1995) view the phenomena considered by those engaged in clinical problem solving go beyond demographic, paraclinical and therapeutic data. They include phenomena such as the symptoms and other overt manifestations of disease, the associated disabilities and other functional impairments, and the reactions of patients and their families. Indeed Feinstein (1995) suggests that social support systems and familial interrelationships need to be identified as they may be important therapeutic adjuncts.

The analysis of topics covered by subjects in this study supports Feinstein’s (1995) view that the focus of clinicians’ attention goes beyond diagnostic labels, demographic details and other “hard” measures of the patient’s status. As he suggests, the nurses in the study focused on the consequences of the patient’s medical diagnosis for them and their families. Thus they considered the patients’ symptoms and other manifestations of their condition and the effect that these had on their functional capacity. This enabled the patient’s nursing problems to be identified. The term nursing problems is used throughout this study to describe those problems which can be ameliorated by nursing intervention, either directly or as a result of referral to another service. The nurse also considered phenomena relating to the patients’ particular circumstances. These included their home environment, social support
structures and the presence of family, and phenomena that led to an understanding of
the patients as people, such as their response to their conditions.

Although Feinstein (1995) described all the phenomena he identified variously as
"human clinical phenomena" or "personal and clinical phenomena," some further
definition is considered helpful. It is suggested that the phenomena that nurses focus
on during the assessment task can be described as those which are purely clinical
phenomena and those which are personal phenomena. Examples of clinical
phenomena include immobility, pain and incontinence. To a large extent the clinical
phenomena attended to will be directed by the nurse's internal representation (or
schema) of the patient's condition, which is activated in response to clinical data in
the presenting situation. An example of this is the schema for Motor Neurone Disease
constructed by subject one (see page 232). This schema directed the nurse to consider
clinical phenomena such as immobility and dysphagia during the course of her
assessment.

Personal phenomena include the patient's demographic details, data relating to his
home environment and family, and information that contributes to an impression of
him as an individual. The findings of this study suggest that personal phenomena
provide the context in which clinical phenomena must be considered. Thus the
contribution of the patients' families and others to their care may obviate the need for
referral to other agencies. The patients' psychological response to their condition may
need to be considered in planning care, for example nurse subject one delayed her
discussion of pressure area care in the light of the patient's reaction to his condition:
"I mean certainly at another time I need to talk to his wife about pressure sores and get a sheepskin but it wasn’t the right time. I heard it and thought, “well..” but he wasn’t ready for that.” (Subject One)

This view is supported by Cowley et al (1996) who suggest that a patient’s needs cannot be assessed in isolation of their context. Their tenet is that community nursing assessment has traditionally encompassed the social context as well as the person’s health or medical status. This extends to an assessment of the needs of the family as a whole and the individuals within it. The findings of this study show that District Nurses do include the patient’s family, in terms of their own needs and their ability to contribute to the care of the patient.

Subjects placed considerable emphasis on attending to personal phenomena and discussed the rationale for this in terms of getting to know the patient and establishing trust.

“My plan is to get to know them so they can trust me because it has to be a two way process and I hope when they trust me that it will come out more…” (Subject three).

“I felt that it was really important they got to trust me, and I got to know them, and I knew that I would be going back.” (Subject one)

“I felt that it was really important he got to know me…I felt that we parted well and I hope they’ll feel they can call on me. (Subject one)

Both nurse subjects adopted similar strategies in trying to establish rapport with their patients, drawing comparisons between the patient’s situation and their own family lives as a way of showing empathy. Nurse subject one noted that the patient’s children and her own must have been at school together. In the recall session she states:
"That sort of social chat is important too. I know I do it with them all and OK it’s letting a little bit of myself, and I hope I don’t do it too much, but it’s important to show that yes, you know I understand, I’ve got children that we’re...." (Subject one)

Subject three discussed the challenge of dealing with major life changes and drew an analogy with her own family leaving home. In the recall session she states “I did that deliberately to relieve it and show empathy”.

The purpose of establishing a relationship with patients seems to be to establish a rapport which will facilitate the delivery of care, particularly in situations where there is likely to be a need for significant psychological and emotional support as in cases one and three. In case one the nurse describes how she did not feel able to provide this type of support at the beginning of the visit as she did not yet know the family well enough:

“I felt we needed to defuse the situation whether that was for me, I think it was for me a bit, because I thought I didn’t know them well enough yet perhaps to be able to offer them what they needed and I think I subconsciously, but deliberately, thought “Right we’ll talk about something a bit safer” and then we can come back.” (Recall One)

Establishing a rapport with patients encouraged them to give their history which helped the nurse to collect relevant data to support the problem solving process. For example nurse subject three started her assessment with a broad general question to elicit the background to the patient’s presenting condition. Her next 25 verbalisations were aimed at encouraging him to continue with his history – “mmm” “yes”, for example. During the recall session she confirmed that she had been deliberately prompting the patient to “keep him going.”
Subjects appeared to attend to personal phenomena in order to get an impression of patients as people and understand their personal circumstances as well as their clinical characteristics. From the data collected in this study three reasons for getting to know the patient have been identified. Firstly, it helps to establish a rapport which facilitates the collection of patient data and supports the assessment of the patient; secondly, it provides additional information which enables the nurse to modify her plans and tailor care to the patient's individual requirements; finally, the relationship between the nurse and the patient provides a vehicle for offering emotional and psychological support.

Jenks (1993) also found that nurses emphasised the importance of knowing the patient in clinical decision making. Her subjects used the word “knowing” to describe the interpersonal relationship with individuals during decision making and expressed a strong need to establish personal relationships with patients to facilitate clinical decision making. One of the subjects reported:

“pain is difficult to assess sometimes because people react to pain in different ways and if you don’t know that person you may not know how to deal with it” (Jenks 1993)

This is a good example of a nurse attending to both clinical phenomena and personal phenomena to judge the patient’s condition. The ability to “read” patients in this way is considered by Benner (1997) to be one of the characteristics of expertise in nursing.

“The clinical aspects of expert nursing are intertwined with the moral and emotional dimensions of your relationship with patients. Your decisions regarding care are made possible by the relationship you develop with your patients and their families.”
In the field of Occupational Therapy, Robertson (1996) found that expert clinicians were more likely to weave a human perspective into their understanding of the client. Students, whilst able to note client's concerns, did not use this data to develop an in-depth understanding of how disability had had an impact on the life of the individual or integrate the information into treatment planning. Robertson (1996) developed a diagram to show human understanding as a significant aspect of problem representation for expert clinicians.
The findings of the study can also be related to the work of Radwin (1995) who described, "knowing the patient" as a core process whereby nurses make therapeutic decisions. She suggests that knowing the patient consists of two components, the first being the nurse’s knowledge or understanding of the patient which is inferred from descriptions of a patient’s experiences, behaviour, feelings or perceptions. The second component is individualised nursing intervention based on knowledge of the patient. She postulated that the process of knowing the patient is facilitated by four strategies: empathising, matching a pattern, developing a bigger picture and balancing preferences with difficulties. The extracts from recall data presented above demonstrate that nurses in this study used empathy in the course of getting to know their patients. Subjects also used broad generic questions in the introductory phase of
the assessment with the intention of getting a general picture before honing down on specific issues.

Getting an overall impression of the patient, in terms of both clinical and personal phenomena, also provides nurses with a base line for comparing their status on subsequent occasions and evaluating their condition as better or worse. Only one subject, subject four, had met the patient prior to the study visit. (This had been necessary to arrange the visit as the patient was not on the telephone.) At the end of the visit she evaluated the patient’s current condition against his condition the previous day:

“I must say you look well today, you look better today than you did yesterday. Maybe it’s because you’ve got your shirt on.” (Subject four)

During the recall session she added to this evaluation.

“He was ashen yesterday. That’s why I said to him you look better today. He’d just got up and he was trying,... he wasn’t even dressed [yesterday], he answered the door to me his underpants.” (Subject four)

In this example nurse subject four was using the clinical phenomena of skin colour (ashen) and activities of daily living (getting dressed) and the personal phenomena of the patient’s level of motivation (“he was trying”) to evaluate the patient’s progress. She described the influence her previous, albeit brief, encounter with the patient had had on her assessment:

“I didn’t want to push it all too far because he did start crying yesterday – keep it on a fairly positive slant because he was starting to get distressed. It did colour – I think going yesterday actually made a big difference to going today. If I’d just phoned him up I think it would have bee – I do think it would have been different, there’s no doubt about it. You know you do take it in what happens.” (Subject four).
In this extract she noted the personal phenomena of distress, evidenced by crying, and made a decision not to pursue a detailed discussion of the patient’s medical condition (“I didn’t want to push it”). Thus it is suggested that the phenomena nurses attend to can be described as clinical phenomena and personal phenomena. Personal phenomena provide the nurse with the context in which she must make decisions about how to respond to clinical phenomena. As noted previously subject one deferred a discussion of pressure sores with the patient because “it wasn’t the right time,” in view of her assessment of the patient’s adaptation to his condition, whilst subject four’s discussion with the patient was directed by the personal phenomena of distress that she had noted.

Feinstein (1983) suggests that the dissection of judgements in this way to identify the observational evidence, salient variables and operational decisions that lead to the conclusion represents an important challenge to clinicians. He describes a similar clinical scenario to the example from case four cited above. A physician is asked to determine on what basis he judges that his patient is “much better today”. He may reply “In contrast to yesterday’s anorexia, today she asked for breakfast and ate it; she is sitting up instead of lying in bed; she has applied make-up for the first time since she was admitted; and she greeted me with a smile instead of a frown.” In this case Feinstein (1983) suggests that the salient variables would be changes in appetite, food intake, posture, use of cosmetics and facial countenance. The physician has therefore attended to these cues and integrated them to formulate a comparative judgement about the patient’s condition.
From an analysis of the phenomena that nurses attend to it is possible to consider a “hierarchy” of clinical phenomena on which they may focus. At one level they must focus on individual cues, such as signs or symptoms, and make some sort of evaluation and interpretation of them. At another level they must combine or aggregate clinical phenomena to consider concepts such as the severity of the patient’s condition, and dependency on others for help with activities of daily living. Indeed Feinstein (1995) argues that the most cogent distinctions in diagnosis, prognosis, and therapy depend on patterns of symptoms, severity of illness, effects of co-morbidity, functional abilities, and other clinical phenomena. These constructs have some similarity with the topic areas identified in table 5.4 such as signs and symptoms, the state of the patient, and activities of daily living. Thus it is suggested that nurses may consider phenomena at various levels of abstraction. At the lowest level they may attend to individual cues, at a greater level of abstraction they may attend to clinical constructs such as pain, immobility, or medical diagnostic labels and finally they may consider more abstract concepts which have implications for the level of nursing care required such as the severity of the patient’s condition and their level of dependency. Further work is need to dissect nursing judgements and identify the phenomena to which nurses attend and the levels of abstraction they construct.

The overview of the phenomena to which District Nurses in this study attended gives an indication of the type of knowledge and skills that delineate the domain of nursing. Carper (1978) suggests that there are four fundamental patterns of knowing in nursing:

- empirics, the science of nursing
- aesthetics, the art of nursing
• the component of personal knowledge
• ethics, the component of moral knowledge in nursing

Thus nursing is underpinned by a scientific knowledge of human behaviour in health and illness, which is necessary for the interpretation of clinical phenomena, and by the aesthetic perception of significant human experiences and a personal understanding of the unique individuality of the self, necessary for the perception and interpretation of personal phenomena. Having identified the topics covered and the phenomena attended to by District Nurses the extent to which those topics were common across the study visit was examined.

5.5.2 Commonality and divergence of topics across and between visits

It was suggested above that identifying those topics which are consistently covered by all subjects will help to determine and delineate the focus of nursing. Some degree of variance between subjects was anticipated, however, given the different clinical problems of the patients in the study. It was hypothesised that if topics were found to vary in accordance with the clinical characteristics of the patient this would provide evidence of a knowledge driven, rather than a menu driven, approach to the assessment of the patient’s condition and their requirements for care. Each topic was examined to assess the extent to which it was covered by the five nurse subjects. Table 5.5 shows the number of topics covered by each nurse subject and the extent to which they were topics which were covered by other nurse subjects and the extent to which they were unique to that assessment.
Table 5.5  Analysis of the extent to which topics are common across cases or unique, by case

<table>
<thead>
<tr>
<th>Nurse Subject</th>
<th>Number of topics covered</th>
<th>Number and percentage of topics covered by at least one other subject</th>
<th>Number and percentage of topics which only occurred in this visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>17 77%</td>
<td>5 23%</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>29 85%</td>
<td>6 15%</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>20 72%</td>
<td>8 28%</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
<td>25 89%</td>
<td>3 11%</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>23 74%</td>
<td>8 26%</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>114 79%</td>
<td>30 21%</td>
</tr>
</tbody>
</table>

When each individual case is examined it can be seen that more than three quarters of the topics covered, 79% on average, occurred in at least one other case with only a fifth (21%) being assessment specific. This suggests that there is a largely common approach to the assessment task. It was postulated that the elements of variance in the subjects’ assessments are a response to the varying characteristics of the situation they encounter.

In order to understand the basis for commonality and divergence of topics covered in the assessment it is useful to examine which topics are common to a number of assessments and which are unique to each assessment. Table 5.6 shows the topics which occurred in more than one case.
Table 5.6 Topics covered by more than one subject during the study visits

<table>
<thead>
<tr>
<th>Topics covered by all five nurse subjects</th>
<th>Topics covered by four nurse subjects</th>
<th>Topics covered by three nurse subjects</th>
<th>Topics covered by two nurse subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background to the presenting problem</td>
<td>Activity level</td>
<td>Mobility: in and out of bed balance going out</td>
<td>Patient’s understanding of his condition</td>
</tr>
<tr>
<td>Bathing/washing</td>
<td>Patient’s current status</td>
<td>Bowels</td>
<td>Appetite</td>
</tr>
<tr>
<td>Level of support from family and other sources</td>
<td>Sleeping</td>
<td>Patient’s personal details</td>
<td>Toileting</td>
</tr>
<tr>
<td>Discussion of plan</td>
<td>Emotional and Mental health status</td>
<td>Driving/parking</td>
<td>Medication</td>
</tr>
<tr>
<td>Hobbies / Social activity</td>
<td>Urinary elimination</td>
<td>Getting dressed</td>
<td>Discussion of treatment/services to date</td>
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<td></td>
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<tr>
<td>Accessing the DN service</td>
<td>Patient’s view of help required</td>
<td></td>
<td>Past Medical History</td>
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<tr>
<td>Smoking</td>
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<tr>
<td>Alcohol intake</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Discussion of treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating</td>
<td></td>
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<td></td>
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<tr>
<td>Pain</td>
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<tr>
<td>Vision</td>
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<tr>
<td>Dentition</td>
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<td></td>
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<tr>
<td>Employment history</td>
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<tr>
<td>Financial status/Benefit entitlement</td>
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<td></td>
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<tr>
<td>Skin condition</td>
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<tr>
<td>Swollen hand</td>
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<td></td>
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<tr>
<td>Patient’s understanding of treatment</td>
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<td></td>
<td></td>
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<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Safety</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fluid intake</td>
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<td></td>
<td></td>
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<tr>
<td>Patient’s progress</td>
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</table>

From table 5.6 it can be seen that only four topics occurred in all five visits. They were: background to the presenting problem, bathing/washing, level of support from family and other sources, and discussion of plan. All the nurse subjects asked an open ended question to try to establish the course of events in the run up to the presenting situation. For example, nurse subject one started the assessment by saying, “I tell you what why don’t you... just tell me a little bit about... about yourself
Subject three prompted the patient to give the background to his current situation by saying, "Now tell me you went into [name of hospital] because your..." Thus the topic *background to the presenting situation* seemed to be used to get a general impression of what had led up to the referral to the District Nursing service before going on to more detail assessment of the patient's condition and their ability to carry out activities of daily living.

The topic of *bathing and washing* was the one activity of daily living that was discussed by all subjects. Although the patient's clinical characteristics were different, they could all potentially have had difficulty with this activity for diverse reasons: a degenerative neurological condition, respiratory distress, heart failure, and a fracture. Indeed, despite the difference in case mix, the patients in this study shared the potential for incapacity in a number of areas and this is reflected in the finding that the topics relating to activities of daily living were usually discussed by more than one subject during the assessment.

The other two topics covered by all subjects, *level of support from family* and *discussion of plan*, related more to determining the requirements for care and planning care. Establishing the patient's family structure and the role of family members and other services in providing care helped the nurse to identify the extent to which the patient was already receiving personal care and/or psychological and social support. She could then identify the requirement for skilled input by the District Nursing service and any further referrals that needed to be made to other services. Thus in case one the nurse asked the patient whether his sons lived with him. In the recall session she explained, "I mean that was one of my things to find out – what family
were around …but we established that quite a young family – 10 year old daughter, and a 19 and 21 year old son so…”

Discussion of plan was the final topic covered by all subjects and this topic occurred several times in each visit, six times on average per visit. It included:

i) specific comments about the nurse’s action in relation to particular problems

ii) plans for future visits

iii) intention to undertake a further assessment

iv) intention to refer to other services and agencies.

Thus, in the assessment made by subject two, the plan is discussed in relation to undertaking the patient’s dressing. “I’m not actually going to touch it because it’s well sealed off.” In visit three the nurse discusses her plan for the next visit. “So I will come tomorrow and I will give you a bath and your injection.” In the visit made by subject four, the plan to undertake further routine observations is verbalised when the subject asks the patient, “Will you have a specimen of urine ready for me as well because I’d like to test that?” Subject one discusses her intention to refer to other services. “Right so just to re-cap, I will get hold of the occupational therapist and I think she’ll need to come and have a look to talk about where she can put some rails.”

Five topics were each discussed in all but one assessment and therefore have a high degree of commonality and so it is worth reviewing what they were and any reasons given for their omission by the one subject that did not cover them. The topics were: activity level, patient’s current status, sleeping, emotional and mental health status and hobbies / social activity. The topic of activity level was aimed at establishing, in broad terms, the patient’s level of activity and overall capacity and often preceded a
more detailed of assessment of their capacity in relation to specific activities of daily living. Examples are given from cases four and five:

Does [name of wife] have to help you quite a lot then?” S4

“As you’ve broken your arm there must be lots of things you can’t do.” S5

This topic was omitted from visit three and the possible explanation for this is that the patient stated at the start of the visit that he could not use his right hand. This led the nurse directly into the consequent examination of his ability to carry out activities of daily living without having to ask a general question at the start of this process.

The topic of current status has a similar purpose to activity levels in that it aims to elicit a general picture of the patient, this time in terms of his state or condition as opposed to capacity for activity. Again it is frequently a prelude to a more detailed analysis of the impact of the patients’ condition on his or her ability to carry out activities of daily living. In two of the four visits where this topic occurred it was the patient who initiated it at the start of the visit.

“I haven’t done anything this morning …I am feeling whacked – completely whacked out.” (Patient, Case 2)

“So basically what I was wanting to ask you about was just how are you getting on?” (Subject 4)

The topic of current status was omitted from the assessment of case one and again the possible explanation for this was that discussion of the circumstances that led up to the presenting situation precipitated a detailed assessment of particular symptoms and the patient’s ability to carry out activities of daily living. Discussion of sleeping was also omitted from the assessment of case one but on this occasion the nurse
commented on this (and the omission of any discussion on pain) during the recall session.

"Inevitably I usually find “oh there’s something I should have asked” about the sleep, in fact that’s something I didn’t ask about, but I didn’t feel…if it was an acute, say surgical discharge, that we were perhaps needing to put an input in that was fairly short term, I would have been a bit more methodical about my questioning. Because I felt that it was really important that they got to trust me, and I got to know them, and I knew that I would be going back so I asked the most pertinent things that I felt at the time but I realise I mean even now, thinking about it, that I didn’t ask and I didn’t ask about pain although you’re not meant to, with MND, to have that much pain but they are things that I will hopefully when I go, I will have an input there, and I can be aware that next time I must ask him about that.” (Recall one)

It can be seen that subject one is conscious of not having included certain topics (sleeping and pain) and the reason for this appears to be more than just an accidental lapse of memory. With regard to sleeping it appears as if the nurse is starting to say that she didn’t consider this to be an issue or a problem in this situation: “I just didn’t feel…” Certainly during the course of the visit there was considerable discussion about the fact that the patient was sleeping on a camp bed and whether or not this was comfortable and one might have expected that difficulty with sleeping would have been raised in this context, particularly by a patient who was as good a historian as this gentleman. It could therefore be suggested that there were no cues in the clinical situation which prompted the nurse to infer a problem with sleep and seek further information on this topic. With regard to pain the nurse appears to have omitted this topic because she would not have expected this to be a problem with Motor Neurone Disease. It therefore did not seem relevant to this clinical scenario.

This leads to another important point. It would appear that nurse subject one had some kind of internal representation of Motor Neurone Disease which guided her expectations of what problems may be present and therefore what topics she needed to
raise. She talks of asking “the most pertinent things that I felt at the time.” It is suggested that her internal representation of the patient’s condition allowed her to determine those topics that were pertinent and those topics that could be omitted from her assessment. During the course of the visit the patient described his difficulties with mobility saying, “My mind wants to do it, my legs won’t go.” In the recall session the nurse interrupted the tape at this point to say:

“Classic remark isn’t it? That’s Motor Neurone Disease isn’t it? Everything you read. No control – my mind wants to but my legs won’t”

Again this implies that she has a mental representation of the construct of Motor Neurone Disease. The nurse hears the patient’s description of his problems and interprets and classifies this as “no control” which acts as a forceful feature or critical cue confirming the “fit” of his symptoms to this construct. This “translation” of what the patient says into a clinically useful cue is supported by the work of Bordage et al (1990) who noted that diagnostic interpretations are improved when the clinician first clarifies and decodes the meaning of the information that the patient is presenting. Thus for example “numbness” becomes paraesthesia or paralysis; “three times in the past two days” becomes “acute and intermittent.” This initial interpretation enables the clinician to access knowledge that is stored in terms of abstract principles rather than lists of particular signs and symptoms.

The two other topics that were discussed in four out of the five assessments were both omitted in case five: emotional and mental health status and hobbies and social activity. During the recall session the nurse discussed the difficulty she had raising the former:

“I wanted to find out about what she felt about her present position and where she was at in life but she just chopped me off short.”
The topic of *hobbies and social activities* was not discussed in either the assessment or the recall session of case five. Possibly this was because the patient was clearly very independent and, unlike the other patients in the study, her condition (fractured humerus) was only temporary. She was expected to make a full recovery and resume her usual activities.

In summary those topics which have a high degree of commonality across assessments can be described as topics which relate to setting the scene and getting an overall impression of the patient:

- **background to the presenting situation,**
- **activity level,**
- **patient's current status,**
- **emotional and mental health status;**

Topics which relate to activities of daily living likely to be compromised for all or most of the patient’s in this study:

- **bathing/washing**
- **sleeping**
- **hobbies/social activity**

And topics which relate to planning care:

- **level of support from family and other sources**
- **discussion of plan**

It is equally important to examine the 29 topics which were covered by one nurse subject and assess the basis for this divergence. Table 5.7 identifies those topics which were raised by only one subject and shows which subject covered them.
Table 5.7 Topics that occurred in only one visit

<table>
<thead>
<tr>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
<th>Subject 4</th>
<th>Subject 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dropped toe</td>
<td>Patient's legs</td>
<td>Patient's adaptation to his condition</td>
<td>Housing</td>
<td>Indigestion</td>
</tr>
<tr>
<td>Cramps</td>
<td>Baseline observations</td>
<td>Self image</td>
<td>Wheelchair</td>
<td>Cystitis</td>
</tr>
<tr>
<td>Fatigue levels</td>
<td>Breathing</td>
<td>Emergency respite care</td>
<td>Swollen ankle</td>
<td>Pressure sore</td>
</tr>
<tr>
<td>Hearing</td>
<td>Allergies</td>
<td>Co-ordination of care</td>
<td></td>
<td>Cooking</td>
</tr>
<tr>
<td>Wife’s health</td>
<td>Pressure areas</td>
<td>Wife’s family history</td>
<td></td>
<td>Bruising</td>
</tr>
</tbody>
</table>

In order to understand the basis for divergence it is useful to consider the topics in terms of the groups or subject areas identified previously (table 5.4). These are shown in table 5.8 below.

Table 5.8 Analysis of topics occurring in only one assessment by topic group

<table>
<thead>
<tr>
<th>Topic Group</th>
<th>Number of topics only covered in one assessment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms and illnesses</td>
<td>9</td>
<td>30%</td>
</tr>
<tr>
<td>The state of the patient</td>
<td>7</td>
<td>24%</td>
</tr>
<tr>
<td>Treatment and services</td>
<td>5</td>
<td>17%</td>
</tr>
<tr>
<td>Family</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>Activities of daily living</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Patient details</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Total number of topics</strong></td>
<td><strong>29</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

From table 5.8 it can be seen that of the 29 topics that are raised by only one subject almost one third (30%) relate to “symptoms or illnesses” that only presented in this
particular patient. The second biggest category of topics related to the “state of the patient.” This would suggest that where divergence occurs it is largely on the basis of the patient’s clinical characteristics. Evidence for this also comes from the recall sessions. For example, it would have been difficult to know whether subject two, who undertook baseline observations, was doing this routinely or in response to the patient’s clinical characteristics. However, in the recall session she explains that she does not take every patient’s blood pressure. “I did it with him because he’d been in heart failure....and it’s good, you know, just to confirm it’s down.” With regard to the pulse measurement she stated “I checked because he’s on Digoxin.”

Topics relating to “treatment and services” account for the third largest group. Discussions on treatment will relate to, and be a consequence of, the patient’s clinical condition. Given that the patient’s clinical characteristics vary it is perhaps not surprising to find that the discussion of particular treatment and services also varies.

In three visits there was some discussion of the patient’s spouse in terms of their own health and requirements for care or support. The particular topics were specific to each family and again reflect that the basis of the divergence of topics was to capture the particular circumstances of the patient’s domestic situation.

It was noted above that because of the shared characteristics of the patients in this study, topics relating to “activities of daily living” tended to be raised by more than one subject. There were three exceptions to this: hearing, breathing and cooking. Hearing was discussed in case one when the patient volunteered that he wore a hearing aid, breathing was discussed in case two where the patient had chronic
obstructive airways disease, and cooking was discussed in case five where the patient had fractured her humerus and usually had responsibility for cooking in the household.

In case five housing was discussed ("patient details") because the patient’s home environment imposed some constraints on his ability to carry out activities of daily living independently. The nurse needed to establish whether he wished to remain in this house and who owned the property as a basis for planning aids and adaptations to improve his environment and consequently his capacity for independence. This problem was only relevant to this particular patient in the study and therefore reflects the fact that the nurse tailored her assessment to address this particular situation.

Finally there was one topic which was assigned to the group of topics addressing the "state of the patient," but which really reflected the style of the nurse in conducting the visit: summary of patient problems. This topic occurred in case five towards the end of the visit when the nurse concluded:

"So your main problems at the moment if I can sum it up are really the pain in the arm. It’s acute. Your bottom we’ve sorted out. Right, your hand has to stay up otherwise it’s going to get blacker and it will make the back of your neck ache I’m afraid."

Whilst this verbalisation contains discussion of the patient’s problems and was therefore categorised as "state of the patient" it is really the fact that the nurse was summarising the problems in this way that makes it a unique occurrence. (This reflects the findings of study one where only one nurse stated the patient’s problems during the course of an assessment.) The basis for divergence is therefore idiosyncratic rather than a product of the patient’s clinical characteristics. During the
recall session the nurse was asked if she usually summarised the patient’s problems in this way:

“I do. Always. Because it’s the only way the patients remember what it was you were talking about when you go out because the time [that has gone] before they don’t really remember most of what you say.”

Given the high incidence of the topic discussion of plan in each visit, and the finding that only one nurse verbalised a summary of the patient’s problems, the results of the second study show that nurses discuss their plans in relation to the problems identified rather than the problems themselves during the course of a visit. Again this replicates the findings of the first study.

In conclusion it would appear that there are some generic topics that occur in all, or the majority, of assessments. They are raised in response to broad, non-specific questions aimed at establishing a general picture of the patient. These topics serve as a prelude to a more detailed and systematic analysis of the patients’ condition and their consequent ability to carry out activities of daily living. This process appears to be driven by the nurse’s internal representation of clinical constructs which gives rise to expectations about the clinical characteristics of patients and therefore the nursing problems they may have. Thus, in the light of the response to generic questions, it is suggested that an internal representation is activated which enables the nurse to anticipate and predict which topics will be pertinent to raise with the patient.

Other topics that occur in all or most of the assessments relate to planning a response to identified problems.
Where variations in the topics covered occurs it seems to be in response to three variables. The first and most important variable is the clinical characteristics of the patient. Variation in the clinical characteristics of patients will give rise to variations in the symptoms and illnesses they present with, their state or condition, the activities of daily living they will have difficulty with and consequently the treatment or services they will require. The second variable relates to the patient’s personal circumstances in terms of the presence of family and social support networks, their financial status and home environment. These factors are likely to exert an influence on the type of care required (or not) in addition to the patient’s clinical characteristics. Finally the third variable relates to the patient’s response to his illness. This includes aspects such as the patient’s understanding of his condition and his treatment and his adaptation to or acceptance of his condition. There was evidence in the second study that in the course of assessing patients and planning their care nurses take account of this third variable:

“I think his grieving for his body image is to him uppermost, I’m not sure that his isn’t a grieving process ….I’m not sure that the disability caused by the actual disease would be too much of a problem if he can come to terms with…psychologically come to terms with it.”

In case one the patient describes how he meets up with other people with Motor Neurone Disease and it makes him realise how lucky he is. During the recall session the nurse interrupted to say:

“And you also realise what’s going to happen to you. I mean that’s the other thing. I mean he was saying “yes, I realise how lucky I am, but I also realise that I’m going to be in a wheelchair and I’m going to be…. That’s the message that I felt was coming through here “ I know what’s ahead.” (Recall one).
At the end of the recall session when she is asked to summarise the patient's problems her reply is dominated by her assessment of the patient's response to his condition.

"He knows what his diagnosis is. He says he's accepted it but I don't think he has. He's frightened. He's an intelligent man and I think he knows what's going to happen and he is reluctant to ask for help because it's actually admitting that he's getting worse. And yet the mere fact that the bed has come down stairs and things are going down hill I think he realises he needs help. I feel that we need to put a nursing input in there." (Subject one).

The findings of this study would suggest that the purpose of an assessment in District Nursing is to plan care for this patient in this situation with this illness and that it is these dimensions which are the source of variation in the assessment process. This finding has a relationship to some important concepts in nursing such as the delivery of holistic and individualised care which emphasises the importance of knowing the patient as an individual (Wilson-Barnett 1988).

5.5.4 The structure of the assessment visit

The findings of the first study suggested that there may be a difference in the structure of the assessment task depending on whether the nurse was given a specific or non-specific remit. It was hypothesised that where the nurse was asked to perform a particular task, such as a wound dressing or an injection, the nursing problem had been "given" and did not need to be actively identified. It was postulated that this intervention would be completed in the early stage of the visit with the rest of the visit being used to screen for further problems not identified in the referral. It was anticipated that this part of the visit would be akin to the routine enquiry described by Gale and Marsden (1984) and Barrows et al (1982).
In order to examine the structure of the assessment visits the sequence of topics in each visit was investigated. (The sequence of topics is shown at Appendix 4). The sequence of topics shows that, as suggested in the analysis of the commonality and divergence of topics (section 5.5.3), the assessment usually commences with broad, generic questions aimed at establishing a general picture of the patient. It is suggested that this may equate to the pattern building described by Gale and Marsden (1983) and Barrows and Feltovich (1987) which precedes pattern recognition. Studies of nurses assessing patients during telephone triage have also found evidence that subjects attempt to build up a picture of the patient early on in the process (Crouch 1988, Edwards 1994). Table 5.9 shows the topics that were covered in the introductory phase of each visit.

**Table 5.9 Introductory phase of the assessment**

<table>
<thead>
<tr>
<th>Case One</th>
<th>Case Two</th>
<th>Case Three</th>
<th>Case Four</th>
<th>Case Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background to the presenting problem</td>
<td>Patient’s current status</td>
<td>Employment history</td>
<td>Patient’s current status</td>
<td>Patient’s current status</td>
</tr>
<tr>
<td>Patient’s understanding of his condition</td>
<td>Patient’s progress status</td>
<td>Patient’s current status</td>
<td></td>
<td>Background to the presenting problem</td>
</tr>
<tr>
<td>Employment history</td>
<td>Medication</td>
<td>Background to the presenting problem</td>
<td></td>
<td>Activity levels</td>
</tr>
<tr>
<td></td>
<td>Patient’s personal details</td>
<td>Level of support from family and other sources</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient’s adaptation to his condition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis of topic sequence shoed that the initial phase is followed by a more detailed discussion of the patient’s capacity in relation to activities of daily living which may be interspersed with the nurse describing her plan in response to any nursing problems identified. This second phase also includes the collection of
information which will inform the planning process such as treatment to date, current
treatment, and the support that the patient is receiving from other sources. This part of
the assessment may conclude with the nurse referring to the prescribed assessment
schedule and gathering data to ensure that it can be completed. Gale and Marsden
(1984) also found that whilst clinicians do use routine enquiry during a clinical
interview, the active role of the clinician in following his own interpretive needs is
the most important factor in structuring the interview. Routine enquiry is used as a
failsafe or background search mechanism and usually only occurs when the active
problem solving phase of the interview is complete. Table 5.10 shows the topics
which occurred during the working phase.
<table>
<thead>
<tr>
<th>Case One</th>
<th>Case Two</th>
<th>Case Three</th>
<th>Case Four</th>
<th>Case Five</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobility</strong></td>
<td>Level of Support Eating</td>
<td>Mobility</td>
<td>Patient’s understanding of treatment</td>
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</tr>
<tr>
<td>Hobbies/social activity</td>
<td>Shopping</td>
<td>Self image</td>
<td>Housing</td>
<td>Swollen hand</td>
</tr>
<tr>
<td>Dropped toe</td>
<td>Driving</td>
<td>Sleeping</td>
<td>Employment History</td>
<td>Sleeping</td>
</tr>
<tr>
<td>Temperature</td>
<td>Background to the presenting problem</td>
<td>Elimination</td>
<td>Housing</td>
<td>Pain</td>
</tr>
<tr>
<td>Bathing/washing</td>
<td>Condition of patient’s legs</td>
<td>Patient’s understanding of his condition</td>
<td>Level of support from family and other services</td>
<td>indigestion</td>
</tr>
<tr>
<td>Cramps</td>
<td>Background to the presenting problem</td>
<td>Employment history</td>
<td>Wheelchair</td>
<td>Bowel function</td>
</tr>
<tr>
<td>Emotional/mental health</td>
<td>Discussion of treatment to date</td>
<td>Benefit entitlement</td>
<td>Emotional and mental health</td>
<td>Urinary elimination</td>
</tr>
<tr>
<td>Fatigue levels</td>
<td>Discussion of plan</td>
<td>Discussion of plan</td>
<td>Activity level</td>
<td>Fluid intake</td>
</tr>
<tr>
<td>Patient’s view of help required</td>
<td>Discussion of plan</td>
<td>Discussion of plan</td>
<td>Washing and getting dressed</td>
<td>Cystitis</td>
</tr>
<tr>
<td>Bathing</td>
<td>Discussion of plan</td>
<td>Hobbies/Social activity</td>
<td>Financial status/benefits</td>
<td>Fluid intake</td>
</tr>
<tr>
<td>Level of support from family and other sources</td>
<td>Housework</td>
<td>Discussion of treatment</td>
<td>Employment history</td>
<td>Skin condition</td>
</tr>
<tr>
<td>Assessing the DN service</td>
<td>Baseline observations Discussion of services available</td>
<td>Background to the presenting problem</td>
<td>Denition</td>
<td></td>
</tr>
<tr>
<td>Past Medical History</td>
<td>Breathing</td>
<td>Emergency respite care</td>
<td>Alcohol intake</td>
<td>Pressure sore</td>
</tr>
<tr>
<td>Appetite</td>
<td>Past medical history</td>
<td>Discussion of service to date</td>
<td>Smoking</td>
<td>Discussion of plan</td>
</tr>
<tr>
<td>Bowels</td>
<td>Smoking</td>
<td>Discussion plan</td>
<td>Patient’s personal details</td>
<td>Driving ability</td>
</tr>
<tr>
<td>Discussion of plan</td>
<td>Alcohol intake</td>
<td>Discussion of plan</td>
<td>Skin problem</td>
<td>Shopping and cooking</td>
</tr>
<tr>
<td>Toilettine</td>
<td>Activity level</td>
<td>Discussion of plan</td>
<td>Sleeping</td>
<td>Dressing</td>
</tr>
<tr>
<td>Hearing</td>
<td>Discussion of treatment</td>
<td>Bathing</td>
<td>Medication</td>
<td>Washing</td>
</tr>
<tr>
<td>Discussion of plan</td>
<td>Past medical history</td>
<td>Wound dressing</td>
<td>Activity level</td>
<td>Bruising</td>
</tr>
<tr>
<td>Wife’s health</td>
<td>Allergies</td>
<td>Eyesight</td>
<td>Access to toilet</td>
<td>Body temperature</td>
</tr>
<tr>
<td>Sleep</td>
<td>Wound</td>
<td>Swollen hand</td>
<td>Housework</td>
<td>Safety</td>
</tr>
<tr>
<td>Pressure areas</td>
<td>Hobbies/Social activity</td>
<td>Swollen ankles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating and drinking</td>
<td>Personal details</td>
<td>Appetite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient’s understanding of treatment</td>
<td>Hobbies/Social activity</td>
<td>Bowels</td>
<td>Husband’s requirements for care</td>
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</tr>
<tr>
<td>Pain</td>
<td>Discussion of plan</td>
<td>Bathing</td>
<td></td>
<td>Husband’s</td>
</tr>
</tbody>
</table>
The final part of the assessment is characterised by discussion of the plan. Table 5.11 shows which topics occurred in this phase.

### Table 5.11 Concluding phase

<table>
<thead>
<tr>
<th>Visit One</th>
<th>Visit Two</th>
<th>Visit Three</th>
<th>Visit Four</th>
<th>Visit Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing the DN service</td>
<td>Accessing the DN service</td>
<td>Discussion of plan</td>
<td>Discussion of plan</td>
<td>Summary of problems</td>
</tr>
<tr>
<td>Bathing</td>
<td>Discussion of Plan</td>
<td>Discussion of plan</td>
<td>Discussion of plan</td>
<td>Discussion of Plan</td>
</tr>
<tr>
<td>Discussion of plan</td>
<td>Discussion of Plan</td>
<td>Patient's adaptation to his condition</td>
<td>Hobbies/social activity</td>
<td>Discussion of Plan</td>
</tr>
<tr>
<td></td>
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<td>Discussion of Plan</td>
<td>Discussion of plan</td>
<td>Discussion of Plan</td>
</tr>
<tr>
<td></td>
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<td>Discussion of Plan</td>
<td>Patient's progress</td>
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<tr>
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<td>Patient's queries</td>
<td>Discussion of Plan</td>
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<tr>
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<td></td>
<td>Discussion of Plan</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Discussion of Plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thus it is suggested that the assessment process can be divided into three distinct phases: an introductory phase in which the nurse establishes the parameters of the patient’s clinical condition, a working phase in which she refines her understanding of the patient’s problems until she is in a position to plan nursing intervention or establish that no care is required and undertakes a screening for further problems, a concluding phase which encompasses discussion of the plan of care.
It is useful to compare the topic sequence identified in tables 5.9, 5.10 and 5.11 with the data from the recall sessions in which nurses discussed their typical style of assessing patients. There is some support from this source for the view that nurses are seeking to obtain a general impression of the patient as well as a more detailed understanding of specific nursing problems. The nurse in recall session three states: “I know about his breathing and his eating and I’ve got a picture so I don’t....” whilst the nurse in recall session one said “I think I got a reasonably good picture of them.”

Based on these results a model to describe the structure of the assessment task is shown below. The three phases of the task and their associated goals are identified along with the type of topics covered in each phase.

*Table 5.12 A model of the structure of the assessment task*

<table>
<thead>
<tr>
<th>Phase</th>
<th>Goals</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory phase</td>
<td>To establish a general picture of the patient in terms of:</td>
<td>Broad generic questions e.g.</td>
</tr>
<tr>
<td></td>
<td>i) the parameters of their clinical condition</td>
<td>Background to the presenting problem</td>
</tr>
<tr>
<td></td>
<td>ii) getting to know them</td>
<td>Patient's current status</td>
</tr>
<tr>
<td>Working phase</td>
<td>To identify the nursing problems and decide on a plan by:</td>
<td>Including patient specific topics from all</td>
</tr>
<tr>
<td></td>
<td>i) establishing the patient’s capacity, clinical characteristics and</td>
<td>the groups:</td>
</tr>
<tr>
<td></td>
<td>individual circumstances</td>
<td>State of the patient</td>
</tr>
<tr>
<td></td>
<td>ii) collecting data to inform the planning process</td>
<td>Activities of daily living</td>
</tr>
<tr>
<td></td>
<td>iii) routine enquiry.</td>
<td>Family</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Treatment and services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Symptoms and illnesses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient’s views and perceptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient details</td>
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<tr>
<td></td>
<td></td>
<td>Planning care</td>
</tr>
<tr>
<td>Concluding phase</td>
<td>To finalise and agree the plan of care</td>
<td><em>Discussion of the plan</em> with the patient</td>
</tr>
</tbody>
</table>

It was suggested earlier that the structure of assessment visits may vary as a result of the specificity of the referral received by the District Nurse. It was postulated that
where the referral contained specific information about the patient’s problem and/or the nursing intervention required, the nurse would address these issues early in the visit. There were two cases which were identified as having a specific remit; case two where the nurse was asked to dress the patient’s leg and case three where the nurse was asked to assess the patient for help with bathing (see table 5.1). In case two the nurse addressed the issue of the patient’s legs as the ninth topic out of 47 topics discussed in all (see appendix 4). Again this specific topic was raised after she had obtained a general impression of the patient through discussion of the patient’s current status, his progress, and the background to the presenting problem. In case three the nurse discussed the issue of bathing, in terms of her plans to help, as the thirteenth topic out of 36 topics. This was much later in the visit and followed quite a detailed discussion on a number of other topics beyond the introductory phase of the visit. However, the patient had attempted to raise the subject of bathing at the end of the fifth topic, patient’s adaptation to his condition. The nurse did not pick up on it at this point and instead raised the topic of eating:

“Well as I say, these kind of problems really since I’ve come home from [name of hospital], um adjustment and with regard to…, one in particular has been bathing.”
(Patient)

“Mmmm, mmm, how about eating, can you, has that been a problem to you?”
(Nurse)

During the recall session she explained that she had raised this “because that was an area of disability and obviously he was disabled to get into the bath because of the hands and I wondered how he managed to eat.” It appears that the nurse regards the problem of bathing as “given” and is pursuing her search for further potential problems in the light of the patient’s condition. When she returns to the issue of
bathing it is not to assess whether the problem exists but to state her plan with regard
to the problem: “What I propose to do is to come and visit you and to help you with a
bath, if that’s agreeable.” In the light of this finding it is suggested that visits vary in
structure depending on whether a discrete physical task is identified as the reason for
the visit at the time of referral. Where this is the case the task and underlying problem
will be dealt with in the early part of the visit. The nurse who received the referral
which asked for an assessment with regard to bathing, inferred that if the patient was
unable to bath there would be other activities of daily living with which he would
have difficulty. She therefore approached the task in the same way as nurses who had
received non-specific referrals. Further evidence that the requirement for a physical
task to be undertaken is the discriminating factor comes from the recall sessions of
cases two and four.

Nurse subject two confirms that the problem of the wound and it’s requirement for a
dressing was “given” at the time of referral:

“If I think, I was probably fairly aware of it when I went in – in the referral I
picked up that the only nursing bit was the dressing obviously from that we
then do the general assessment.” (Subject two)

“If there’s an immediate need to be seen to, say he’d cut himself or he had a
leg ulcer, I mean there’s actually something physical to do and I would get on
with that first and then just gradually as the time allowed…” (Subject four)

This finding is also supported by the findings of the first study where nurses dealt
with topics that were associated with a physical intervention early in the visit and then
undertook a routine enquiry to see whether they were any further problems.
Case two also varies from the other visits in that it is the only visit where the nurse systematically worked through the assessment form in the patient's home. She did this after she had dealt with the issues highlighted in the referral information: the dressing and problems with housework. During the recall session the nurse subject was asked if this was her usual practice:

"It is now. I didn't used to. I used to do a more off the cuff assessment but I find those forms have got to be filled in as they're [kept] in the house now so I find it's the easiest way of working through." (Subject 2)

Later in the recall session the nurse seems to contradict herself when she says:

"I think having the assessment form means it can be a bit disjointed and I seemed to have a general chat first not in any particular order just basic general information and then go through that in the order it's down so that it's all filled in." (Subject 2)

What appeared to happen was that the assessment of case two had an introductory phase like all the other assessments which seems to equate with the nurses description of "a general chat". The working phase was divided into two: dealing with the problems given in the referral and undertaking a routine enquiry to screen for further problems. The concluding phase was again comparable with other visits and largely contained discussion of the plan. Thus two distinct visit structures have been identified one for assessments where a nursing task is suggested and one for assessments where no specific nursing action is identified. Table 5.13 shows the model of the structure of an assessment visit where the nursing task is given in the referral information.
Table 5.13 A model of the assessment task where the intervention required is “given” in the referral information

<table>
<thead>
<tr>
<th>Phase</th>
<th>Goals</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory phase</td>
<td>To establish a general picture of the patient in terms of:</td>
<td>Broad generic questions e.g.</td>
</tr>
<tr>
<td></td>
<td>i) the parameters of their clinical condition</td>
<td>Background to the presenting problem</td>
</tr>
<tr>
<td></td>
<td>ii) getting to know them</td>
<td>Patient’s current status</td>
</tr>
<tr>
<td>Working phase</td>
<td>To address the problem given in the referral and screen for further</td>
<td>Topics relevant to the given problems e.g. for visit two:</td>
</tr>
<tr>
<td></td>
<td>by:</td>
<td>state of the patient’s legs</td>
</tr>
<tr>
<td></td>
<td>i) further developing an understanding of the given problem until a</td>
<td>wound dressing</td>
</tr>
<tr>
<td></td>
<td>plan of care can be formulated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii) routine enquiry</td>
<td></td>
</tr>
<tr>
<td>Concluding phase</td>
<td>To finalise and agree the plan of care</td>
<td>Discussion of the plan with the patient</td>
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</table>

Another source of variance in subjects’ approach to the assessment task appeared to be their judgement of whether the client required short term or long term care. Thus subject one describes how she placed greater emphasis on establishing a relationship with the patient and asking the most relevant questions at this point in time, because she knew she would be involved with the patient on a long term basis. She suggested that her approach would have been different if the patient had only required short term intervention.

“I realise he was going to be a long term person, the care I was going to give to him and so some of the questions I said to you earlier, like sleeping habits and like some of the finer details, I didn’t actually ask and I didn’t feel it was relevant. If it was somebody who was much more acute much more short term I would have been a bit more specific. I felt that it was really important that he got to know me. I think I got a reasonably good picture of them.” (Subject One)

Subject four also suggested that she would make a distinction between clients requiring short and long term care:
"I do like to get a bit of background to people in that sort of situation where it’s a long term care well I mean if it’s sorted out now it needn’t be a problem long term. If it’s left another 18 months or 2 years it’s then a very, very, very, big problem. So you can take your time on it.” (Subject four)

The distinction between short and long term patients is closely associated with the requirement for specific physical intervention. In describing short term care both the nurses used as an example patients who would require dressings. The distinction therefore seems to be about the number, range and complexity of problems as well as the length of time the nurse will be involved. Inevitably patients who have a higher number of complex problems are likely to be long term.

Another point made by the nurses is that on their first visit they focus on those phenomena which are particularly relevant knowing that they will have subsequent opportunities to assess the patient. This suggests that they regard assessment as a continuous process rather than a one off activity. Indeed in order to determine a patient’s progress the nurse assesses his condition at each encounter. Cowley et al (1996) also conclude that community nursing assessment has traditionally been an ongoing activity rather than a single event. This finding is further evidence that, within the clinical setting, assessment is a temporally unfolding event. Crow et al (1995) also suggest that assessment is a dynamic process. They identified similarities and differences between medical diagnosis and nursing assessment. Both processes have been found to involve a directed information search and both lead to predictive judgements. However, the underlying purpose appears to be different in medicine and nursing. The medical diagnosis provides a causal explanation of the patient’s signs and symptoms. In nursing the purpose of assessment is to produce an accurate picture of the patient’s current condition or the consequences of a particular diagnosis for a
particular individual. As a result the nursing assessment will change over time with the patient's condition whilst the medical diagnosis remains constant.

Having established the structure of assessment visits the question of whether the nurse's approach to the assessment task is knowledge driven or menu driven can be considered. This distinction is about whether the subject collects and interprets data in response to a knowledge based internal representation of the presenting situation or collects data in a prescribed or routine format.

Four out of the five cases in this study followed the structure described by table 5.12. It is suggested that during this type of assessment the introductory phase enables the nurse to activate an internal representation of the patient's condition which guides the search for further problems that the nurse would expect a patient with this condition to have. Certainly none of the nurses in the four assessments of this type used the prescribed assessment schedule to direct the course of the visit. This issue was discussed in the recall sessions:

"I realised he was going to be a long term person, the care I was going to give to him and so some of the questions [on the prescribed assessment schedule] I said to you earlier, like sleeping habits and like some of the finer details, I didn't actually ask and I didn't feel it was relevant." (Recall One)

"I know about his breathing and his eating and I've got a picture so I don't.. I mean I've got to get.. to make sure I've got the facts correct but the rest I can fill in. I know about his finances and everything so I can fill that form in back here now.... Wouldn't have a form in front of me." (Recall Three)

"I don't tend to go rushing in with bit of paper I think, you know, if there's an immediate need to be seen to say, he'd cut himself or he had a leg ulcer, I mean there's actually something physical to do and I would get on with that first and then just gradually as the time allowed – it just depends on the urgency of the visit – but I do like to get a bit of background to people in that sort of situation where it's a long term care well I mean if it's sorted out now it needn't be a problem long term." (Recall Four.)
"It's my normal practice [not to complete the assessment form during the visit]. Very occasionally I will complete it during the visit and um sometimes I can say look this is so interesting that I really can't remember all that you're telling me I'm going to have to write it down or you're telling me so much my brain is getting quite muddled up and I'm going to have to separate this and write it down...I just got the form out to just check that my boxes were full I don't normally go by the form I go by what the patient....I use it to jog my memory.” (Recall Five).

For these nurses, the assessment form seemed to serve two purposes: it was a form which needed to be completed as part of the patient record and an aide memoir which could be used as a prompt when the active phase of problem solving was over and they were screening for further problems. This latter use of the prescribed assessment schedule equates to the routine enquiry phase of the diagnostic interview described by Grant and Marsden (1984) and Barrows et al (1982).

The implication of this finding is that the nurse is structuring the course of the assessment visit herself, largely determining what topics are addressed and in what order. This would suggest that the way in which the nurse works through the problem solving task is dependent on her internal representation of the problem. This raises questions about the way in which nurses' knowledge is organised and structured.

5.5.5 The organisation and structure of nurses' knowledge

The finding that four out of five nurse subjects did not use a prescribed assessment schedule would lead to the hypothesis that the assessment process is driven by nurses' internal representation of the patient's condition which creates an expectation that certain clinical features and nursing problems will exist. Nurses' internal representations may also contain information about the likely treatment and management of the patient's condition. It is therefore postulated that nurses' knowledge is organised as clusters of related elements or schema, as described in
chapter four, and that these schema contain identification, elaboration, and planning knowledge (Marshall 1995). It is suggested that the schema activated by nurses during the assessment task enable them to recognise patients’ current nursing problems, predict their future nursing problems and plan treatment to address those problems. In order to elicit a better understanding of the knowledge structures that may be driving the assessment process two assessments have been examined in more detail: case one and case five. In case one the patient has a degenerative neurological condition which will require long term nursing input. By way of contrast the patient in case five has a temporary disability from which she is expected to recover.

In case one the patient has a diagnosis of motor neurone disease and the nurse’s internal representation or schema guides what information she collects and provides the context for interpreting the information she receives. It also enables her to anticipate the patient’s current problems and predict what his problems are likely to be in future. When she discussed her examination of the patient’s dropped toe in the recall session the nurse said,

“I felt then I was almost sure what I was going to find, but I felt they wanted me to actually do something and ....his toe was exactly as I expected it would be, but that was.. and they knew what I was going to say didn’t they? I mean they knew it was his disease.” (Subject One)

She was able to anticipate problems with the patient’s ability to feed himself and swallow:

“The other reason why I suggested the coffee is that I thought “good I’ll see him drinking.” I must admit I thought “oh good I’ll be able to see how he’s managing or whether his wife has to feed him” without having to ask him.” (Subject One)
Equally she was able to anticipate problems caused, not by the disease itself, but by the consequences of the disease. Thus the nurse identified constipation and risk of pressure sores as possible problems that would occur as a result of the patient’s reduced mobility. It would appear that aside from the medical diagnosis there are other key phenomena, such as immobility, which enable the nurse to anticipate and predict problems. The patient in case one reported that he seemed to be lying in one position all night. During the recall session the nurse stated:

“I mean certainly at another time I need to talk to his wife about pressure sores and maybe get a sheepskin but it wasn’t the right “ (Recall One)

“The only thing that sometimes happens is that because you’re not moving about as much as you perhaps used to that sometimes you get constipated, not because of the Motor Neurone Disease, but because of the fact that you’re not moving about so much, so it’s quite important... I mean did he [the doctor] talk to you about having brown bread and roughage and eating fresh vegetables.” (Subject one)

The two extracts above also show how closely juxtaposed are the identification of a nursing problem and the plan for its solution. This would suggest that the nurse’s internal representation of the problem also contains strategies for its solution. Further evidence of this was found during the visit when the nurse anticipated that the patient was receiving physiotherapy for his mobility problems and may need quinine for his cramps.

The nurse used her internal representation of motor neurone disease to evaluate data she received about the patient’s condition in terms of its “fit.” Thus she considered his poor motor control to be “classic” and his emotional status to be in part due to his illness:
"I think it was two fold I mean I know that with MND your emotions are a bit like MS, they say I mean I don’t know whether this is true or not that um it’s, you have high and lows, and he certainly presented like that, I think he’s frightened and I think he’s justifiably anxious and depressed....but I mean I think OK it’s probably part of, they say it’s part of motor neurone disease, but I think it’s also he’s frightened." (Subject one)

There was also evidence that the nurse’s internal representation enabled her to predict the course of the patient’s illness. Many of her interventions were aimed at preparing for the time when the patient was going to be more disabled than at present. She explained this in the recall session.

“Certainly we can get over a few physical problems at the minute by putting some aids and things in there, and I think we need to put them in before they’re actually...I think we need to have them set up so that he’s got used to the idea of them being there. Because we know it’s going to get worse. It’s not going to be static, it’s not we might need it, we will need it...I think at the moment yes, he’s probably managing reasonably well at the moment. I mean there’s no desperate problem – he’s standing up, he’s eating and drinking he’s got no swallowing problems yet, although I asked him about his drinking and he obviously knows – he knew what I was referring to.” (Subject One)

From the data collected in both the visit and recall protocols it is possible to model the internal representation that subject one has of Motor Neurone Disease (figure 5.3) and show how this is used to underpin the problem solving process. In describing the schema a framework based on Marshall’s (1995) four knowledge types (identification, elaboration, planning and execution) was used. Execution knowledge was not incorporated as this aspect of the knowledge was not observed during the study visit or recall session. However, it is reasonable to postulate that this includes knowledge of referral process and performance of procedures such as bathing and measuring vital signs as these were all cited by the nurse subject as actions she intended to carry out.
### Figure 5.3 Schema for Motor Neurone Disease

<table>
<thead>
<tr>
<th>Identification Knowledge</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Medical diagnosis of Motor Neurone Disease, a degenerative neurological condition</td>
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</table>

<table>
<thead>
<tr>
<th>Elaboration Knowledge</th>
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</tr>
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<tbody>
<tr>
<td>- long term</td>
<td></td>
</tr>
<tr>
<td>- progressive</td>
<td></td>
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<tr>
<td>- loss of balance</td>
<td></td>
</tr>
<tr>
<td>- loss of motor control</td>
<td></td>
</tr>
<tr>
<td>- difficulty swallowing</td>
<td></td>
</tr>
<tr>
<td>- difficulty speaking</td>
<td></td>
</tr>
<tr>
<td>- no cognitive impairment</td>
<td></td>
</tr>
<tr>
<td>- no sexual dysfunction</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Planning knowledge</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations of nursing problems:</td>
<td></td>
</tr>
<tr>
<td>- further decline in mobility</td>
<td></td>
</tr>
<tr>
<td>- pressure sores as a consequence</td>
<td></td>
</tr>
<tr>
<td>- constipation as a consequence</td>
<td></td>
</tr>
<tr>
<td>- difficulty with eating and drinking</td>
<td></td>
</tr>
<tr>
<td>- emotional response to deteriorating condition</td>
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</tbody>
</table>

Plans:
- refer to physiotherapist
- refer to OT
- supply bed and pressure relieving aids
- ensure high fibre diet
- provide psychological support
- refer for carer support
- nursing intervention to assist with personal hygiene

Goals:
- establish a trusting relationship with the patient and his family
- manage current problems
- plan for predicted problems either to prevent them arising or to ensure optimal management when they do occur.

It is suggested that nurses’ internal representation of disease states enable them to place patients at a certain point on a health-illness continuum, and this provides a basis for establishing how close they are to recovery or whether their condition is deteriorating. In a similar way nurses attempt to judge patients’ present condition by comparing it to how they have been previously. Evidence for this type of evaluation of whether the patient is better or worse is found in the topic *patient’s progress*. Thus in case five the nurse asks:
“Right. Now is the bruising in your hand definitely getting better today, the bruising in your hand is definitely less today?” (Visit Five).

Case five also provided further evidence to support the idea that the schema activated by an individual directs the course of the assessment task. Here the patient had a medical diagnosis or fractured humerus and dislocated shoulder. The emphasis of nurse subject five’s assessment was the consequence of this condition for the patient. This is reflected in both her opening statement to the patient – “As you have broken your arm there must be lots of things you can’t do” and her comments during the recall session:

“My main theme was what problems have you got, how do you cope with them, where can I fill the holes. What do you want me to do? If I can’t do it I’ll tell you how we can cope with it. That’s my general approach.” (Subject Five).

A review of the topics covered and explanations given shows how subject five’s internal representation of clinical entities directed the issues that were addressed by her and the order in which she raised them. Thus she introduced the subject of sleep with the patient because she anticipated this would be a problem in view of her pain:

“Her main concern was her arm, and sitting was difficult and extending her hand was difficult so sleeping inevitably puts the arm in a completely different position so I went immediately into sleeping as an extension of the pain.” (Subject Five).

Another example of this is when the nurse picks up on the pattern of urinary elimination at night that the patient had described. She asks a series of questions aimed at identifying the patient’s pattern of urinary elimination:

Do you have problems during the day as well as during the night?  
How many times at night do you have to get up?  
And how many times do you go during the day?  
Do you get an urgency after you have decided to go?
In the recall session the nurse explains that “I wanted to establish the pattern of continence and I wanted to establish the reasons behind it.” One of the clinical states activated, or considered, by the nurse in response to the patient’s replies was that of urinary tract infection. The nurse stated in the recall session, “I wondered if she had a urinary tract infection. I wondered if in fact she was drinking too little.” This led her to ask questions about the patient’s fluid intake and conclude that this was low. The clinical state of dehydration appears to have been activated next with the nurse asking the patient whether her skin was dry and whether she had a dry mouth. In the recall session she explains:

“I was looking at her skin because I was looking at her any way but it was just the relation of moisture to moisture just finding out if she was actually dried out. Her lips looked dry...I was also [inaudible section of tape] diabetes because all of ...that was something I was following through. If she was drinking more than she was saying she was and then she was having to go to the loo all the time it’s just possible she’s diabetic. Dry mouth is one if the signs and her shins, if I ask them the dry shins, she might if it was diabetic might have had a what do you call it. The front of the leg becomes quite uncomfortable in a lot of diabetics doesn’t it...the word’s totally gone! And er she would may be even be triggered to tell me that she’d got the pain perhaps even lack of feeling at all – neuropathy so ummm that was the reason.”

It would seem then that the information given by the patient contains critical cues or forceful features which activate clinical schema stored in the nurse’s long term memory. For nurses it appears that clinical schema may be organised around a medical diagnosis such as Motor Neurone Disease (nurse subject one) or diabetes (nurse subject five) or around clinical states or conditions such as immobility or dehydration. These schema then serve as a guide for the collection of further data. This data may, in turn, contain other critical cues which activate further schema, moving the nurse through the problem space. The figure overleaf traces this progress:
Figure 5.4 The Information Used During a Line of reasoning (Subject Five)

Information:
Nocturnal pattern of urinary elimination

Schema activated:
Incontinence due to:
? Infection
? Low fluid intake

Information:
Dry Mouth

Information:
Fluid intake is low

Schema activated:
Dehydration
Diabetes
In conclusion it would appear that the structure of assessment visits is determined by the nurse actively responding to cues in the presenting situation which trigger the activation of schema, based on clinical, though not necessarily medical diagnostic, phenomena. These schema then guide the search for further data and thus determine which topics are covered by the nurse and in what order. As suggested in chapter four, the activation of schema and subsequent search for evidence to confirm the match of the presenting situation to the schema can be considered as a form of hypothesis testing (Marshall 1995, Schmidt and Boshuizen 1995).

The discussion thus far has focused on the organisation of subjects' knowledge with respect to clinical phenomena. However, it is suggested that there are broadly four types of schema: person schema, self schema, role schema and event schema (Augoustinos and Innes 1990). This latter type of schema provides the basis for anticipating the future, setting goals and making plans and describes the type of schema that nurse subjects were found to develop in relation to clinical events or phenomena. Person schema research has focused on abstracted conceptual structures of personality traits or person prototypes which enable a person to make inferences from the experience of interactions with other people. This research would suggest that subjects have an internal knowledge structure that enables them to interpret personal, as well as clinical, phenomena and anticipate the personal characteristics of their patients. It is suggested that each encounter with a new individual gives rise to key questions (Cantor and Mischel 1979a):

- The “typing” question – “What kind of a person is he or she?”
- The causality question – “Why did he or she behave that way?”

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• The prediction question – “What will he or she do next?”

• The evaluation question – “Do I like this person?”

Within the clinical situation nurses need to be able to determine the type of person a patient is as much as they need to determine their clinical condition. They need to be able to understand the reasons behind a patient’s behaviour and anticipate future behaviour. It is suggested that people have well structured and stable representations in memory of the attributes associated with different personality types. These personality prototypes serve as standards against which incoming information about a particular individual is matched and evaluated (Cantor and Mischel 1979b). Internalised personality prototypes enable people to structure the encoding of new information about an individual and provide expectations about the future behaviour or actions of that individual. The findings of the study described here suggest that, when attending to personal phenomena, subjects identified relevant cues, which activated schema or inferences, this led to a directed search for further information until a judgement pertaining to personal phenomena was reached. This judgement provided the basis for planning action in relation to personal phenomena. Examples from verbalisations by Subject One are shown below:

**Relevant cue**
He sounds near to tears so many times

**Activated schema / inference**
*Fear of deterioration* “I think he was very frightened about what he was going to be like. and that was why I specifically asked him that question.”

**Directed data search**
[Do you understand what MND is?]

**Judgement**
He says he accepts it but I don’t think he has. He’s frightened. He’s an intelligent man and I think he knows what’s going to happen and he is reluctant to ask for help because it’s actually admitting he’s getting worse.
Plan

I feel we need to put a nursing input in there. I think they need support from us and I think that’s what caring and that’s what nursing’s all about isn’t it? I think we need to be there.

Thus this subject used cues in the presenting information to determine the “type” of person this patient was (fearful of his deterioration). This prototype helped her to encode further information (reluctance to ask for help) and understand the cause of the patient’s behaviour. It also helped her to plan to support the patient in the face of his physical decline. From this process it can be inferred that the subject’s schema contained identification knowledge which helped her to recognise the schema, elaboration knowledge which indicated what other data to collect and planning knowledge which helped to determine a course of action.

In summary the findings reported in this section have shown how nurses organise their knowledge in relation to both clinical and personal phenomena. It is suggested that both types of knowledge are organised as schema that contain identification, elaboration, and planning knowledge (Marshall 1995).

5.5.6 Flexibility in thinking

In addition to evidence of an organised knowledge structure stored in memory, evidence was also found of flexibility in thinking which Bordage et al (1990) considered to be another factor associated with successful diagnostic thinking in medicine. They developed an inventory of diagnostic thinking which contained items associated with flexibility in thinking such as: responsive to patient’s line of thought, clarification before further data acquisition, recall of previous information, clinician-patient control of the interview, completeness of enquiry. Each item contained a stem with a six point semantic differential scale. The way in which these items were
presented in the inventory is shown below. The letter in brackets after each item indicates which statement, right or left, is the better of the two.

**Responsive to patient’s line of thought (R)**

Throughout the interview,

If I follow the patient’s line of thought I tend to lose my own thread. I can still keep my ideas clear even if I follow the patient’s line of thought.

**Clarification before further data acquisition (R)**

When I cannot make sense of the patient’s symptoms,

I move on and gather new information to trigger new ideas. I ask the patient to define those symptoms more clearly.

**Recall of previous information (L)**

When a piece of information comes along and makes me think of a possible diagnosis,

It often makes me go back to previous information to see if things fit together. It rarely makes me review information that I gathered previously.

**Clinician-patient control of the interview (L)**

Throughout the interview I manage to test my ideas even if I let the patient control the interview.

I manage to test my ideas even if I let the patient control the interview I am only successful if I can control the direction of the interview

**Completeness of the enquiry (L)**

In terms of the way I conduct an interview,

I usually cover the ground that I need to during the interview. Quite often I do not ask all the questions that I need to at the time.

The visit protocols were reviewed to see whether there was evidence of these processes, which would serve as an indicator of flexibility in thinking.
Responsiveness to patient’s line of thought

Subject One asked the patient’s wife if she was getting tired and she responded by telling the nurse that they had decided to move her husband’s bed downstairs. S1 recognised this must be an important issue for them and continued the discussion. In the recall session she states:

“That was a big...that was not the question I asked at all so obviously so that had been a major event hadn’t it, moving the bed downstairs, and I, later on I came back to it several times because a) I felt the bed was very uncomfortable b) I mean they’re quite – she’s younger than him – they’ve obviously got a ten year old they’re obviously still having a sexual relationship and I felt that I was able to infer it without it being uncomfortable towards the end I don’t know...and that if you like was deliberate too because I thought at some stage I mean, MND, your sexual function is not affected and I felt possibly at a later date that was something that they both needed, they probably know about it, but perhaps it needed to be confirmed, but that was deliberate. They certainly, they all knew what I meant.”

In case one the patient and his wife raised the topic of his toe. During the recall session S1 shows how she deliberately responded to their line of thought.

“I felt then I was almost sure what I was going to find, but I felt they wanted me to actually do something and I thought then “shall I go and wash my hands and come back” and I thought “no I can’t they want me to do something, to look” and his toe was exactly as I expected it would be, but that was... and I thought “there’s no point in saying oh I’ll do it next time or I’ll look” and they knew what I was going to say didn’t they? I mean they knew it was his disease.”

Clarification before further data acquisition

An example of this would be the series of questions which were asked by Subject Four in relation to the patient’s skin condition:

You’ve had it ever since have you?
And how long is it?
Is it irritating as well?
Have you had any creams for it?

Subject Five also asked a series of questions, previously cited, to clarify the patient’s symptoms in relations to urinary elimination.
Recall of previous information

Subject Five introduced the topic of urinary elimination by recalling that during the discussion on sleep the patient had said she went to the toilet several times in the night:

“It sounds like you rush anyway when it comes to the waterworks.”

Subject Four recalled several pieces of information the patient had given her the previous day when she arranged access for the study visit, indicating that these were forceful features in relation to the particular problem areas e.g. mobility:

“You said yesterday that you had a few problems getting about and that the stairs was one of them.”

“You said yesterday you could only get as far as the gate.”

Clinician-patient control of the interview

The discussion on visit style showed that nurses tended to ask broad general questions at the beginning of the interview to get the patient talking and then homed down on the issues raised in this introductory phase. This was particularly noticeable in case three where the nurse asked an opening question which encouraged the patient to give the background to his presenting condition. Her next 25 verbalisations were aimed at encouraging him to continue with this history e.g. “yes” “mmm” “right” etc. During the recall session she stated:

“I mean I always say “yes” to people to encourage them to keep going so that was a prompt really. I used that as a prompt to keep him going rather than ask.”

In a similar way Subject One reflected on the fact that she had been able to gather a lot of information by allowing the patient to give his own account of events. During the recall session she stated:

“I mean we’ve got so much information without asking anything really. All the things I was thinking at the back of my mind they all came out.”
Completeness of enquiry

The evidence for this item was presented earlier in the chapter when it was demonstrated that the clinical schema activated in the introductory phase of the visit determine what topics the nurse will cover during the assessment visit. The nurse raises issues that she considers to be the most pertinent and may decide to defer discussion of some topics to subsequent visits. Assessment is seen as a continuous process and judgements to defer certain topics are made in the light of the patient’s physical and emotional response to their condition.

In conclusion there is some evidence that nurses in this study showed flexibility in thinking as described by Bordage, Grant and Marsden (1990). The analysis of topics covered and the order in which they were raised suggest that nurses have a memorised knowledge structure that is organised around clinical concepts. They use this to determine the impact of a patient’s physical condition on him/her as an individual in his/her particular circumstances. The style and structure of the assessment visit demonstrates flexibility in thinking which has been shown to be associated with successful clinical problem solving (Bordage et al 1990). A difference in visit structure has been found where the nurse is requested to undertake a particular nursing task.
5.6 SUMMARY

In summary, this chapter has described the findings in relation to the first two aims of the study. The content of District Nursing knowledge was described by identifying the topics covered during assessment visits. The topics identified were consistent with other similar studies (Crow et al 1996, Luker and Kenrick 1992, and Spicer 1993). Topics raised by nurses were found to cover both clinical and patient phenomena, with patient phenomena providing the context for the interpretation of clinical phenomena. Thus, in addition to the patient’s clinical characteristics, nurses placed emphasis on getting to know the patient and understanding his emotional and psychological response to his condition. They used this knowledge to modify plans and proposals for care to meet the patient’s individual requirements.

The nurses’ choice of topic and the order in which they raised topics gave an indication of their internal representation of the problem. Nurses’ internal representations of the patient’s condition were found to be organised as schema which enabled them to predict the clinical characteristics the patient might present with and thus the topics they should raise. These schema were activated by triggering cues in the clinical setting and once activated they provided the basis for further data collection until the patient’s nursing problem, a problem which can be alleviated by nursing intervention, either directly or indirectly, could be identified. The schema enabled the nurse to predict the nursing problems the patient may have in the future and also contained proposals for responding to the patient’s condition.
The structure of assessment visits was identified and found to consist of an introductory phase, a working phase and a concluding phase. There was some evidence that visit structure would vary if the referral information suggested that a specific physical task was required. In this instance the task was carried out in the first part of the working phase with the rest of the working phase broadly constituting a screen for further problems. The consistency of structure across visits and the explicit verbalisations by subjects on their approach to assessment suggest that nurses do employ plans for structuring the assessment task and this may represent an example of the complex operator “structuring plans” described by Huber (1989).

In conclusion the findings reported in chapter five have enabled the content and structure of District Nurses knowledge to be determined. The way in which subjects structure the assessment task has also been described. Chapter six reports the findings in relation to the third aim of the study, identifying the cognitive operators used by nurses during problem solving. By combining the two sets of data a comprehensive and integrated picture of nurses’ clinical reasoning will be derived.
CHAPTER SIX

COGNITIVE OPERATORS USED DURING THE ASSESSMENT OF PATIENTS

6.0 INTRODUCTION

In chapter five it was suggested that problem solving could be understood as a journey through the problem space with cognitive operators serving as paths that move the individual from one knowledge state to the next until the solution is found. This chapter describes the cognitive operators that subjects were found to use during the assessment task. The findings in relation to cognitive operators are then combined with the findings in relation to the content and organisation of District Nurses' knowledge to give a comprehensive picture of problem solving in the clinical setting. A Line of Reasoning (Hassebrock 1992) is used to represent problem solving because it combines both knowledge and cognitive processes.

6.1 THE IDENTIFICATION OF COGNITIVE OPERATORS – DEVELOPING A CODING FRAMEWORK

The operator approach is used to define explicitly the set of operators used for altering knowledge states during the course of the problem solving task and the problem solving process is then modelled as a sequence of such cognitive operators (Huber 1989). According to Neisser (1983) a cognitive operator is a cognitive unit which is well defined and stable and which does the same thing in every context. The following diagram (Diagram 6.1) represents the way in which Huber (1989) described cognitive operators:
A distinction is made by Huber (1989) between elementary and complex operators. Two types of elementary operators are identified: general or unspecific operators which are part of an individual's general repertoire of operators and those operators that are specific to decision making and problem solving tasks. For example, the specific operator EVAL is defined by Huber (1989) as a judgement process. EVAL+ and EVAL – are like EVAL but produce a positive and negative evaluation. Complex operators consist of a sequence of several elementary operators and three types of complex operators are identified by Huber (1989): subheuristics, structuring plans and decision heuristics. The subheuristics he identifies resemble well known heuristics, such as the subheuristic DOMINANCE which enables the selection of the dominant alternative from a range of possibilities, but do not lead to a decision. A structuring plan is an operator employed by the decision maker in response to an overwhelming amount of information. In such situations the individual employs plans for structuring the task. The plan is used to structure the process of decision making. This operator is of relevance to this study in relation to how District Nurses structure the assessment task when the purpose or goal of that task is not clear and they need to determine what information is of relevance.
A decision heuristic produces as its output one (i.e. the best) alternative. It consists of the following components: it contains at least one subheuristic and possibly other simple or complex operators; it contains at least one evaluation of the difference between the problem state and the goal state; it may contain structuring plans (Huber 1989).

For the purposes of this study a coding framework to identify elementary operators was developed. In developing the coding framework consideration was given to other studies in which researchers had identified cognitive operators. Ericsson and Simon (1993) identified that verbalisations in a protocol could be encoded in terms of the processes that produced them. Verbalisations may be a literal copy of information presented to the subject which makes it impossible for the investigator to infer whether it has been processed semantically and understood. Alternatively they may be a paraphrase of information presented which implies that the semantic content has been heeded. A verbalisation may be neither a literal nor semantic copy of information presented but may be generated from such information. Finally information that was heeded previously may be recalled or retrieved. From this analysis they identified three major processes: read, paraphrase, and inference processes.

By way of contrast Hassebrock (1992) developed a much more detailed coding schedule which identified eight conceptual operations, defined as cognitive processes which modify existing knowledge states and produce new, active knowledge states. The conceptual operations characterise distinct components of a physician’s problem solving behaviour and are further analysed to provide a more detailed representation
of reasoning behaviour. The conceptual operations and their specific operators are shown in Table 6.1 below. In reviewing Hassebrock’s (1992) coding schedule it is perhaps useful to recall the distinction Huber (1989) made between elementary and complex operators. It could be argued that the specific operators Hassebrock (1992) identifies are examples of the elementary operators described by Huber (1989) whilst the conceptual operations are examples of Huber’s (1989) complex operators comprising, as they do, a sequence of several elementary operators.

**Table 6.1 Description of conceptual operations and specific operators (Hassebrock 1992)**

<table>
<thead>
<tr>
<th>2.1 Date examination</th>
<th>a) Read</th>
<th>b) Identify</th>
<th>c) Examine</th>
<th>1) Compare-to-norm</th>
<th>2) Compare-to-expected</th>
<th>3) Determine-severity</th>
<th>4) Compare-over-time</th>
<th>5) Identify-location</th>
<th>6) Compare-multiple</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 Data exploration</td>
<td>a) Examine</td>
<td>b) Scan</td>
<td>c) Search</td>
<td>d) Elaborate</td>
<td>e) Integrate</td>
<td>f) Note-absent-data</td>
<td>1) Compare-to-norm</td>
<td>2) Compare-to-expected</td>
<td>3) Determine-severity</td>
</tr>
<tr>
<td>2.3 Data explanation</td>
<td>a) Infer-pathophysiological-cause</td>
<td>b) Infer-natural-history</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Hypothesis generation</td>
<td>a) Trigger</td>
<td>b) Further-specification</td>
<td>c) Association</td>
<td>d) Causal-relationship</td>
<td>e) Generalization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 Hypothesis evaluation</td>
<td>a) Confirmation</td>
<td>b) Disconfirmation</td>
<td>c) Discrimination</td>
<td>d) Causal-relationship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6 Discrepancy processing</td>
<td>a) Recognition</td>
<td>b) Resolution</td>
<td>1) Ignore</td>
<td>2) Explain-away</td>
<td>3) Systems-thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7 Meta-reasoning</td>
<td>a) Experiential-memory</td>
<td>b) Cue-diagnosticity</td>
<td>c) Diagnostic-plan</td>
<td>d) Self-evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.8 Summarization</td>
<td>a) Repeat-data</td>
<td>b) Repeat-hypothesis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two studies have been carried out which specifically attempt to identify the cognitive operators used by nurses. Fonteyn and Grobe (1993) examined the cognitive processes of 10 critical care nurses who were instructed to plan the care of a critically ill patient presented in a case study. Data was collected through a tape recorded "think aloud" session as the nurse undertook the task and a follow up interview which was also audio taped. From the verbal protocols which were subsequently produced the authors identified four operators to explain the subject's predominant reasoning processes: study, conclude, choose and explain. Fonteyn and Grobe (1993) define the operator study as the process where subjects considered information attentively. The operator conclude was said by Fonteyn and Grobe (1993) to apply when the subject made a decision about the significance, value or meaning of the information available. This activity appears to equate with making a judgement or inference based on the data presented. The operator choose was said to refer to the nurse's choice of nursing action or treatment. This activity could equally well be described as making a decision. The operator explain was applied when the nurse provided a rationale for her choice of action or treatment.

Fonteyn, Kuipers and Grobe (1993) and Fonteyn and Grobe (1993) described the characteristics of expert nurses reasoning in the following way. Although the nurse subjects were presented with a large amount of data they were selective about which elements they considered attentively (study). This information seemed to evoke a pattern matching strategy or heuristic in which nurses compared features of this case to problems previously encountered. Subjects would therefore make a judgement, or conclude in Fonteyn and Grobe's (1993) terms about the meaning of data based on its fit in relation to an internal, memorised pattern of similar problems. Subsequently
subjects decided on or *chose* the actions or treatments that were needed to resolve the problems identified. Finally, subjects provided a rationale or explained their choice, often in relation to overall treatment goals.

In a similar study Crow et al (1996) investigated the assessment of medical and surgical patients in an acute hospital. Like Hassebrock (1992) they identified the main operations which occurred during the assessment process. Again it is suggested that these represent complex operators (Huber 1989) which can be further analysed to elicit the elementary operators. The operations they identified were data gathering, data interpretation, goal generation, evaluation and planning. They went on to identify seven cognitive operators which they defined as processes carried out on the data being examined. The table below shows the operators and their definitions.

*Table 6.2 Definitions for operators describing activity in protocols (Crow et al 1996)*

<table>
<thead>
<tr>
<th>Operator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read</td>
<td>Looking at the data</td>
</tr>
<tr>
<td>Interpret</td>
<td>Interpretation of the data being studied</td>
</tr>
<tr>
<td>Goals</td>
<td>The aim of the activity / process</td>
</tr>
<tr>
<td>Plan</td>
<td>The organisation of the activity / process to achieve the goal</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Evaluation of the treatment, plan or patient</td>
</tr>
<tr>
<td>Reason</td>
<td>Why they are carrying out the activity / process</td>
</tr>
<tr>
<td>Prediction</td>
<td>A prediction of future state / treatment / need</td>
</tr>
</tbody>
</table>

There are some similarities between the coding schemes developed by the two different groups of researchers (Fonteyn and Grobe 1993, Crow et al 1996). For example, the operator *study* (Fonteyn and Grobe 1993) and the operator *read* (Crow et al 1996) both imply heeding or attending to the presented data in some way. The
operators explain and reason are both about the subjects giving a rationale for an activity or process. The operators conclude and interpret are also similar in that they both involve deriving meaning from the data presented.

A review of the approaches used to identifying cognitive operators has established the importance of distinguishing between elementary and complex operators. The coding framework for this study used elementary operators because they are the "building blocks" of complex operators and therefore need to be elicited first. The review of the studies (Fonteyn and Grobe 1992, Crow et al 1996) in nursing has identified some common reasoning processes and provided the basis for the development of the coding framework for this study. The procedure for developing the framework is described below.

6.1.1 Procedures for developing the coding framework used in this study

As stated earlier, data for this study was collected using the same methods as the first study. Thus two verbal protocols were elicited for each assessment visit. The first was a transcript of the visit itself and the second was a transcript of the recall session which followed the visit. The data was analysed by developing a coding framework where each category described an elementary cognitive operator as described above.

At the start of the analysis, the visit and recall protocols were read through in their entirety to provide the overall context for the subsequent analysis. Each visit transcript was then broken down into segments which consisted of discrete topics covered by the nurse during the assessment visit. Each topic segment was then examined to see which cognitive operators were applied to move the nurse through this aspect of the problem solving task. Where there was evidence of cognitive
operators described in previous studies these categories were used as part of the
coding schedule. Where there was evidence of cognitive operators not previously
described these were added to the coding schedule. The transcripts were analysed in
the order in which the visits occurred. Where a category emerged as a “new”
category the previous data was re-examined to see if this category applied. The
development of the coding framework was thus a cyclical and iterative process. Table
6.3 below shows the categories identified.

**Table 6.3 Coding framework for cognitive operators**

<table>
<thead>
<tr>
<th>Operator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read</td>
<td>Reading of written material e.g. written information in the patient’s home.</td>
</tr>
<tr>
<td>Search</td>
<td>Collection of data or evidence to support the existence of possible patient states or requirements for care</td>
</tr>
<tr>
<td>Interpret</td>
<td>Interpretation of the data, indicating the meaning has been inferred</td>
</tr>
<tr>
<td>Inference</td>
<td>A conclusion about the state of the patient</td>
</tr>
<tr>
<td>Predict</td>
<td>An inference about the future state of the patient or their future requirements for care</td>
</tr>
<tr>
<td>Reason</td>
<td>The rationale for an inference, an action, a plan, or a line of enquiry (Search)</td>
</tr>
<tr>
<td>Plan</td>
<td>A stated intention to undertake an activity or collect further data</td>
</tr>
<tr>
<td>Action</td>
<td>A nursing intervention. This includes the giving of advice and information and giving an explanation to the patient.</td>
</tr>
<tr>
<td>Observe</td>
<td>A verbalisation of something that the nurse has directly observed.</td>
</tr>
</tbody>
</table>

A number of categories were used which had been described by Crow et al (1996): *interpret, predict, reason, and plan*. However, for this study the definition of *plan* was different. *Plan* here refers to statements by the nurse of her intention either to collect more information or to do something. In Crow et al’s (1996) study it refers to “the organisation of the activity / process to achieve the goal.” Crow et al’s (1996) definition appears to be more akin to the activity of structuring the task which Huber (1989) suggests is a complex operator.
Four additional operators were identified in this study: search, action, observe and inference. It is suggested that the first three of these operators were identified because the study was conducted in the naturalistic setting. In previous studies written problem simulations were used which meant that subjects had to "read" or "study" the information presented. Indeed, Ericsson and Simon (1993) suggest that the read process accounted for almost one third of verbalisations in one of their studies. In this study the subjects only have the information they have received via a referral at the start of the problem solving task. They must therefore actively seek information from the patient on the basis of what data they consider to be relevant in a particular scenario. Baron (1994), for instance, asserts that thinking consists of search and inference. It is suggested that the critical aspect of the search process is that the thinker has the goal of finding some sort of mental representation of a possibility, a piece of evidence, or goal. The search is therefore directed by the goals and possibilities and the evidence already available.

The possible “cueing” effect caused by giving information to subjects in written simulations was discussed in chapter two. Lamond et al (1996) have also identified that nurses undertaking an assessment task use verbal information twice as much as any other single source of information, while observation and written information are used less often. They therefore suggest it is not appropriate to use written information as the only source of information available to subjects. The design of this study avoids any possible cueing effect and ensures that the cognitive operators identified are more likely to reflect those used in clinical practice. Indeed the operator read is only included in this study because in one case (Case 1) the patient and his wife had prepared some written notes about his condition which they gave to the nurse to read.
during the course of the visit. This was the only example of a nurse subject using written material during the course of the study.

The naturalistic setting is also likely to account for the identification of the operator action. The subjects in this study were undertaking assessment visits on real patients in their own homes and were therefore required to take nursing action, where it was indicated, in addition to assessing the patient. In the context of this study action consisted of the nurse giving advice to the patient on how to manage his condition or conveying relevant factual information – on available services, for example. This type of nursing action provided evidence of the nurse’s knowledge base and her recognition of the applicability of this knowledge to the presenting situation. It can therefore be argued that whilst this operator describes behaviour, it is behaviour that has an explicit cognitive component. In looking at the sequence of operators it was considered important to understand when nursing action occurred in relation to the other cognitive operators. The decision was therefore made to include the action operator in the coding framework for this study.

The operator observe again reflects the naturalistic setting of the study. In addition to asking questions, nurses used direct observation as a way of obtaining information about the state of the patient. This operator was applied when nurses verbalised what they had directly observed.

Finally the operator inference was used to capture verbalisations in which the nurse made a judgement or reached a conclusion about the state of the patient.
6.2 CONTENT ANALYSIS

Following the content analysis of the visit protocols to establish what topics had been covered, described in the previous chapter, the visit and recall protocols were content analysed to determine what cognitive operators were used by nurses to move through the problem space. For identification of the cognitive operators, verbalisations within each topic segments were assigned to one of the coding categories described above (table 6.3). Again once all the protocols had been analysed the results were tested for their reliability. Secondly, each protocol was further divided into segments within topics. Each segment was coded using a coding framework to identify the cognitive operators the nurse was using to move through the problem space. The frequency and the sequence of operators were analysed to investigate whether common patterns could be identified.

6.2.1 Reliability

In order to determine reliability of the coding framework an independent coder was asked to assign verbalisations within topic segments to one of the 9 cognitive operator categories. Again the problem of one rater assigning an element of data to a category whilst the other rater made no assignment occurred. The same approach was therefore taken to reporting reliability as described in chapter five. The first measure indicates the agreement between the raters when a tenth category was added representing inability to make a rating.

Table 6.4 Inter rater agreement, including missing judgements

<table>
<thead>
<tr>
<th>Percentage agreement</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa value</td>
<td>0.44</td>
</tr>
</tbody>
</table>

255
From table 6.4 it can be seen that even with missing judgements included in the calculation the raters achieved moderate agreement. Table 6.5 shows the level of agreement between raters when they both categorised an element of data.

Table 6.5 Inter rater agreement when both raters assigned data to a category

<table>
<thead>
<tr>
<th>Percentage agreement</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa value</td>
<td>0.88</td>
</tr>
</tbody>
</table>

The results in table 6.5 show that when both raters assign an element of data to a category the level of agreement is very high with the kappa value being almost perfect (Landis and Koch 1977). The issue of “missing judgements,” or occasions when one rater categorised an element of data and the other did not, will discussed later in the chapter (see section 6.3.1). Based on the results shown in tables 6.4 and 6.5 the coding framework was judged to be reliable.

6.3 RESULTS

The third aim of the second study, which this chapter reports on, was to identify the cognitive operators used by District Nurses in the course of assessing patients in order to understand what cognitive processes they utilise. Table 6.3 lists the nine cognitive operators that were identified in the development of the coding framework: read, search, interpret, inference, predict, reason, plan, action, observe. This framework was used to content analyse the transcripts of both the study visits and the recall sessions.

6.3.1 Frequency of occurrence of cognitive operators

The first part of the analysis consisted of determining the frequency with which verbalisations made during the visits and recall sessions could be ascribed to the categories identified. The results are shown in table 6.6.
Table 6.6 — Frequency of verbalisations made during assessments which depict the use of cognitive operators

<table>
<thead>
<tr>
<th>Case</th>
<th>Read</th>
<th>Search</th>
<th>Interpret</th>
<th>Inference</th>
<th>Predict</th>
<th>Reason</th>
<th>Plan</th>
<th>Action</th>
<th>Observe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>52</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>13</td>
<td>35</td>
<td>18</td>
<td>132</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>69</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>20</td>
<td>24</td>
<td>4</td>
<td>129</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td>6</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>78</td>
<td>6</td>
<td>2</td>
<td></td>
<td>2</td>
<td>20</td>
<td>11</td>
<td>6</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>79</td>
<td>6</td>
<td>3</td>
<td></td>
<td>15</td>
<td>25</td>
<td>62</td>
<td>2</td>
<td>192</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>319</td>
<td>27</td>
<td>13</td>
<td>2</td>
<td>36</td>
<td>120</td>
<td>155</td>
<td>12</td>
<td>686</td>
</tr>
</tbody>
</table>

Having established the frequency with which each of the cognitive operators was used it is possible to determine a rank order.

Table 6.7 Rank order of cognitive operators by the frequency of use

<table>
<thead>
<tr>
<th>Operator</th>
<th>Total number of operators (n = 686)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>319 (46%)</td>
</tr>
<tr>
<td>Action</td>
<td>155 (22%)</td>
</tr>
<tr>
<td>Plan</td>
<td>120 (17%)</td>
</tr>
<tr>
<td>Reason</td>
<td>36 (6%)</td>
</tr>
<tr>
<td>Interpret</td>
<td>27 (4%)</td>
</tr>
<tr>
<td>Inference</td>
<td>13 (2%)</td>
</tr>
<tr>
<td>Observe</td>
<td>12 (2%)</td>
</tr>
<tr>
<td>Read</td>
<td>2 (0.5%)</td>
</tr>
<tr>
<td>Predict</td>
<td>2 (0.5%)</td>
</tr>
</tbody>
</table>

From table 6.6 and 6.7 it can be seen that the operator search accounts for almost half the verbalisations coded across the five cases. This is a similar finding to the results found in the first study where 25% of verbalisations related to collecting data and 33% were related to the collection of further data on a topic. It occurs more than twice as frequently as any other operator. The two other most frequently occurring operators are action and plan. Together search, action and plan account for 85% of the verbalisations coded.
Tables 6.6 and 6.7 also show that few verbalisations from the visit data can be coded as *inferences*. Indeed in visits two and three no such verbalisations occur. Similarly the operator *predict* which relates to inferences about the future state of the patient only occurs in visit one.

In the discussion on reliability the problem of missing judgements was identified. In the sample of data from the visit protocols that was tested for reliability a total of 179 ratings were made when data was assigned to cognitive operator category. On 55 of these occasions only one rater made a judgement on the element of data. Whilst the coding framework was judged reliable for distinguishing *types* of cognitive operator used it may be a less reliable tool for determining the *frequency* of occurrence of cognitive operators if not all instances when an operator is used are identified. The operator categories identified by the missing judgements were analysed to see whether, if included, they would change the rank order of cognitive operators used by nurse subjects during assessments. This analysis showed that missing judgements were assigned to only four cognitive categories, *action*, *reason*, *interpret* and *inference* and that the same rank order was maintained as in the results for the total sample.

Verbalisations made during the recall sessions were examined in the same way. Table 6.8 shows the frequency with which verbalisations depicted the use of cognitive operators.
It can be seen from table 6.8 that no verbalisations were coded as depicting the operators read, search and action. This reflects the difference between the recall session and the study visit. The recall session took place immediately after the visit at the nurse’s base. Only the investigator and the nurse were present. The audio tape of the visit was played and the nurse was asked to describe her thinking throughout the visit. There was no written material available which accounts for the fact that the cognitive operator read was not used. As the patient was not present the nurse could not seek further data and so the operator search was not used. However, within the operator plan subjects did suggest that there were searches they intended to carry out on future visits. Again because the patient was not present there was no opportunity for any nursing intervention to occur and so the operator action was not used.

As a consequence of the differences in occurrence there was a shift in the rank order in which cognitive operators were used. This is shown in table 6.9.

### Table 6.8 Frequency of verbalisations made during recall sessions which depict the use of cognitive operators

<table>
<thead>
<tr>
<th>Recall</th>
<th>Interpret</th>
<th>Inference</th>
<th>Predict</th>
<th>Reason</th>
<th>Plan</th>
<th>Observe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>17</td>
<td>11</td>
<td>36</td>
<td>19</td>
<td>2</td>
<td>86</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>13</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>4</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>-</td>
<td>28</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>17</td>
<td>-</td>
<td>15</td>
<td>13</td>
<td>9</td>
<td>61</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>13</td>
<td>4</td>
<td>15</td>
<td>13</td>
<td>3</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>68</td>
<td>19</td>
<td>83</td>
<td>56</td>
<td>18</td>
<td>269</td>
</tr>
</tbody>
</table>
Table 6.9 Rank order of cognitive operators by frequency of use during recall sessions.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Percentage of all verbalisations (n = 278)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason</td>
<td>30%</td>
</tr>
<tr>
<td>Inference</td>
<td>25%</td>
</tr>
<tr>
<td>Plan</td>
<td>20%</td>
</tr>
<tr>
<td>Interpret</td>
<td>13%</td>
</tr>
<tr>
<td>Predict</td>
<td>6%</td>
</tr>
<tr>
<td>Observe</td>
<td>6%</td>
</tr>
</tbody>
</table>

From table 6.9 it can be seen that *reason* is the most frequently used cognitive operator in the recall session. This finding is largely accounted for by the fact that subjects were asked to describe their thinking during the recall session and frequently did this by explaining the reason or rationale for a particular question or series of questions. Interestingly the operator *inference* which accounted for only 2% of the verbalisations during the study visits accounted for 25% of the verbalisations made during the recall sessions. This suggests that subjects do make inferences during the assessment task but that these are not explicitly verbalised during the visit. The operator *plan* was ranked third in both the visit and recall data indicating that subjects continued to engage in planning during the recall session, after the visit had concluded.

Those occasions when only one rater assigned data to category were examined. Within the 20% of recall data that was tested for reliability there were 310 categorisations of data. Of these 105 were made by one rater only. The cognitive operator codes assigned to these “extra” categorisations were reviewed. The same finding pertained in relation to the operator *reason* in that it continued to be the most frequently occurring operator and *plan* continued to be ranked third. However, the
position of the operators interpret and inference was reversed. With the data being assigned to the category interpret twice as frequently as the operator inference. When the categorisations of data that both raters coded are examined, it can be seen that they agreed on the use of the category inference 14 times and on the category interpret 8 times. However, there were 8 occasions when one rater coded an element of data as inference whilst the other coded it as interpret or vice versa. This would suggest that the distinction between the two categories is not always apparent.

6.3.2 Analysis of cognitive operator sequences

In addition to identifying the frequency with which cognitive operators were used the sequences in which they occurred were examined in order to understand how subjects worked through each of the topics previously identified.

The transcript of each of the five study visits was segmented into topics as previously described. Each topic segment was then content analysed to determine which cognitive operators the subject used to work through the topic. Examples are shown below from case 2 and case 4.

Case 2

| TOPIC: Medication
| INITIATOR: Search > Search > Interpret > Search > Search |

Case 4

| TOPIC: Bathing
| INITIATOR: Observe > Plan > Plan > Plan > Search |

The first finding was that sequences of cognitive operators could be classified according to length with three distinct groups emerging: sequences of less than five cognitive operators, sequences of five to nine cognitive operators and sequences of ten
or more cognitive operators. Table 6.10 shows the distribution of the group frequencies of operators.

*Table 6.10 Length of operator sequence*

<table>
<thead>
<tr>
<th>Sequence length</th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>V4</th>
<th>V5</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short &lt; 5</td>
<td>10</td>
<td>36</td>
<td>25</td>
<td>25</td>
<td>21</td>
<td>117 (70%)</td>
</tr>
<tr>
<td>Medium 5-9</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>37 (22%)</td>
</tr>
<tr>
<td>Long 9 &gt;</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>13</td>
<td>13 (8%)</td>
</tr>
</tbody>
</table>

Table 6.10 shows that for the majority of topics (70%) subjects utilised a maximum of four cognitive operators. However for a small minority (8%) of topics subjects utilised more than nine cognitive operators (with a maximum of 22 operators being used on one occasion). The topics where a long sequence of operators occurred were examined in order to account for this variation.

*Table 6.11 Topics where a long sequence of cognitive operators was utilised.*

<table>
<thead>
<tr>
<th>Case</th>
<th>Topic</th>
<th>Number of cognitive operators applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dropped toe</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>Level of support from family and others</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>Discussion of plan</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Hobbies/social activities</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>Medication</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Pain</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Bowel function</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>Pressure sore</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>Shopping and cooking</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Safety</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>Husband’s continence</td>
<td>22</td>
</tr>
</tbody>
</table>
There seem to be two explanations for long operator sequences; firstly the nurse may need to undertake several searches and interpret the data she receives in order to sufficiently refine her understanding of the problem with which the patient is presenting. Secondly the patient’s problem or potential problem may be clear but the nurse needs to give a lot of advice and explanation to the patient about how the problem could be managed. The topic of “husband’s continence” in case five is an example of a topic where the nurse spent time clarifying the problem until she understood it sufficiently to move to action and plan. The following extract from case five shows the dominance of the search operator. (The patient’s responses are not shown).

<table>
<thead>
<tr>
<th>Nurse’s verbalisations</th>
<th>Cognitive operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>I understand your husband does have a problem with his continence. Does he?</td>
<td>Search</td>
</tr>
<tr>
<td>Is he?</td>
<td>Search</td>
</tr>
<tr>
<td>Tell me about it.</td>
<td>Search</td>
</tr>
<tr>
<td>So he uses a bottle at night does he?</td>
<td>Search</td>
</tr>
<tr>
<td>Is he very wet during the day?</td>
<td>Search</td>
</tr>
<tr>
<td>Is it only the pants and trousers or the seat as well?</td>
<td>Search</td>
</tr>
<tr>
<td>And it’s how many times a day, do you think, he probably has an accident?</td>
<td>Search</td>
</tr>
<tr>
<td>That is a problem you don’t see as a problem in other words</td>
<td>Interpret</td>
</tr>
<tr>
<td>Well you can get a, like a pocket sanitary towel, I suppose I can describe it, where everything can be tucked inside and then if they do have an accident it only happens in this padded pocked and then you can just change this pocket.</td>
<td>Action</td>
</tr>
<tr>
<td>It’s quite simple, quite simple. But it’s remembering to use it I think with someone like your husband.</td>
<td>Action</td>
</tr>
<tr>
<td>He would have to change it, yes, yes.</td>
<td>Action</td>
</tr>
<tr>
<td>Perhaps I will see if I can get them if you would like to try them.</td>
<td>Plan</td>
</tr>
<tr>
<td>I can’t get those for Monday.</td>
<td>Action</td>
</tr>
<tr>
<td>I can’t get those for Monday...</td>
<td>Action</td>
</tr>
<tr>
<td>Because I don’t have those in my cupboard</td>
<td>Reason</td>
</tr>
</tbody>
</table>
Right because they're a specialist thing
So we’ll have to order some of those
When I’ve got them I’ll bring them across..
But I might not be able to get those for at least a week.
It does add to your stress though doesn’t it
Have you got a washing machine?
Right and a tumble drier or do you put things out?
Can Jackie do that for you?

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Frequency of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>11</td>
</tr>
<tr>
<td>Action</td>
<td>6</td>
</tr>
<tr>
<td>Plan</td>
<td>3</td>
</tr>
<tr>
<td>Reason</td>
<td>2</td>
</tr>
<tr>
<td>Interpret</td>
<td>1</td>
</tr>
</tbody>
</table>

From the extract above it can be seen that search occurs almost twice as frequently as any other operator, with action and plan being the other two most frequently occurring operators as found previously (see table 6.7). Table 6.12 shows the frequency of operators occurring during this topic (husband’s continence).

**Table 6.12 Frequency of cognitive operators during the topic husband’s continence**

A further examination of the occurrence of the operator search suggests that the purpose of data collection is two fold. Firstly subjects undertake a search to clarify the patient’s condition. The first seven instances of search in the extract shown above are examples of this. Secondly search is used to gather data which may be needed for planning purposes. The last four instances of search are examples of this. In this example the nurse is attempting to establish how the patient is coping in practical terms with her husbands incontinence.

The following extract from case five shows the second pattern of operator frequency where the emphasis is on advice and explanation to the patient and planning
intervention, rather than determining the nature of the patient’s problem. The topic under discussion here is *bowel function*.

<table>
<thead>
<tr>
<th>Nurse’s verbalisations</th>
<th>Cognitive operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>They’re [tablets] more likely, they’re not likely to give you indigestion, they are likely to make you constipated.</td>
<td>Action</td>
</tr>
<tr>
<td>Have you, because the longer you take them the more likely you are to be constipated. Do you take anything to help?</td>
<td>Search</td>
</tr>
<tr>
<td>You haven’t taken any thing to help your bowels at all?</td>
<td>Search</td>
</tr>
<tr>
<td>Right but the trouble with taking any form of pain killer is that they all make you constipated if you take them continuously like this.</td>
<td>Action</td>
</tr>
<tr>
<td>Did Dr. ---- not give you a laxative of any description?</td>
<td>Search</td>
</tr>
<tr>
<td>No softener?</td>
<td>Search</td>
</tr>
<tr>
<td>Would you like me to ask him for one, just in case?</td>
<td>Search</td>
</tr>
<tr>
<td>Well I shall ask for some just in case and then if you do need some then you’ve got them haven’t you, you don’t have to worry about it.</td>
<td>Plan</td>
</tr>
<tr>
<td>Because what happens is that it dries everything out and makes it hard,</td>
<td>Reason</td>
</tr>
<tr>
<td>So what we sometimes do is to give you a mixture which you can stir into water and drink down – it’s not an evacuant</td>
<td>Action</td>
</tr>
<tr>
<td>Alright, it’s just something that keeps it soft and that’s much more comfortable, so it doesn’t make you rush to the loo.</td>
<td>Action</td>
</tr>
</tbody>
</table>

Table 6.13 shows the frequency of occurrence of cognitive operators within the topic.

**Table 6.13 The frequency of cognitive operators during the topic bowel function**

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Frequency of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>5</td>
</tr>
<tr>
<td>Action</td>
<td>4</td>
</tr>
<tr>
<td>Plan</td>
<td>1</td>
</tr>
<tr>
<td>Reason</td>
<td>1</td>
</tr>
</tbody>
</table>
It can be seen from table 6.13 that the operator action was used almost as frequently as search. Where search was used the purpose was to gather information that would support planning by establishing the patient’s current management of the potential problem of constipation. In conclusion, where long operator sequences occurred they either represented instances where the nursing problem required clarification before action or planning, or instances where the subject gave advice and information to the patient. The former sequences were dominated by the operator search, the latter showed a more even distribution between search and action.

Table 6.10 showed that the majority of operator sequences (70%) were short with a further quarter (22%) being of medium length. No clear relationship between topic and length of sequence emerged. There was a tendency for medium sequences to be associated with the topic groups symptoms or activities of daily living which were likely to be affected by the patient’s condition. Discussion of plan was also a medium length topic in all cases except for one instance in case one.

The length of operator sequences was also considered in relation to the three phases of the visit: the introductory, working and concluding phase. The results of this analysis showed that short operator sequences tended to occur in the introductory phase of the visit. Table 6.14 shows the topics covered and the number of operators applied during the introductory phase of the visit. In cases three, four, and five all the topics had short sequences of cognitive operators, in cases one and two, one of the topics was of medium length. It is suggested that this finding relates to the purpose of the introductory phase of the visit, described in chapter five. During the introductory phase of the visit subjects asked broad questions and encouraged the patient to keep
talking with responses such as "yes", "mmm" and "uh huh." The number of verbalisations per topic made by the nurse during this phase of the visit was low in order to allow the patient to give their account. This enabled the two goals of the introductory phase, getting a general picture of the patient's condition and getting to know the patient, to be achieved.

No pattern in relation to the length of operator sequences emerged for the working and concluding phases of the visit.
Table 6.14 Number of cognitive operators applied in topics raised during the introductory phase

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic</td>
<td>Sequence length</td>
<td>Topic</td>
<td>Sequence</td>
<td>Topic</td>
</tr>
<tr>
<td>Background to the presenting problem</td>
<td>1</td>
<td>Patient’s current status</td>
<td>-</td>
<td>Employment history</td>
</tr>
<tr>
<td>Patient’s understanding of his condition</td>
<td>3</td>
<td>Patient’s progress</td>
<td>1</td>
<td>Patient’s current status</td>
</tr>
<tr>
<td>Employment history</td>
<td>3</td>
<td>Medication</td>
<td>5</td>
<td>Background to the presenting problem</td>
</tr>
<tr>
<td>Patient’s personal details</td>
<td>1</td>
<td>Level of support from family and other sources</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient’s adaptation to his condition</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

S denotes short operator sequences, <5
M denotes medium length operator sequences, 5-9
6.3.3 *Sequence ordering of cognitive operators*

The sequence ordering of cognitive operators was examined to determine whether any patterns emerged. Certain cognitive operators, such as *search* and *action*, tended to be repeated in short chains, as shown by the extracts above. For example in the extract from case five on page 263 the operator *search* occurs 11 times. However, when the pattern of occurrence is examined it can be seen that the operator was repeated 7 times consecutively and then 4 times consecutively. The operator *action* occurred 6 times, 3 times consecutively once as a pair and once singly.

Other operators such as *reason* and *predict* tended to occur singly or in pairs. Table 6.15 shows the frequency with which operators occurred in consecutive chains, by length of chain.

*Table 6.15 Length of repetitive chains for cognitive operators*

<table>
<thead>
<tr>
<th>Operator</th>
<th>Length of repetitive chain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Read</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>76</td>
</tr>
<tr>
<td>Interpret</td>
<td>21</td>
</tr>
<tr>
<td>Inference</td>
<td>8</td>
</tr>
<tr>
<td>Predict</td>
<td>2</td>
</tr>
<tr>
<td>Reason</td>
<td>29</td>
</tr>
<tr>
<td>Plan</td>
<td>44</td>
</tr>
<tr>
<td>Action</td>
<td>38</td>
</tr>
<tr>
<td>Observe</td>
<td>10</td>
</tr>
</tbody>
</table>

From table 6.15 it can be seen that the operator *search*, for example, occurred 76 times singly, 50 times as a pair, 14 times as a consecutive chain of three, 15 times as a consecutive chain of four, 4 times as a consecutive chain of five, twice as consecutive chain of six and once as a consecutive chain of seven. The results show that the
operators *search*, *action* and *plan* tend to occur in chains whereas all other operators usually occur singly or in pairs. (The only exception to this is one chain of four of the operator *reason* which occurred in visit five when the nurse was giving her rationale for pursuing some investigations).

The operator *action* described verbalisations in which the nurse gave advice, information or an explanation to the patient. The nature of the information the nurse subjects were conveying meant that several consecutive verbalisations were required to achieve this.

Whilst the operator *plan* mostly, occurred singly (on 57% of the occasions it was used), it occurred in pairs and in chains of up to five repetitions. This tended to happen within the topic *discussion of plan* which, as described in chapter five, was found to embrace a number of elements (action in relation to the nursing problem, plans for the future visits, intention to undertake a further assessment, intention to refer to other services and agencies).

As noted earlier in this chapter Baron (1994) suggests that thinking can be described in terms of a search-inference framework and that during the search process the thinker’s goal is to find some sort of mental representation of a possibility, a piece of evidence or a goal. The finding that the operator *search* tends to occur in repetitive chains of some length supports the view that the search process is incremental, with each new piece of data or evidence prompting the next search strategy until the subject has gathered enough data to make a judgement, about what state pertains, or a decision, about what action should be taken as a consequence. The visit extracts
included above show how the nurse subjects used the operator *search* to accumulate information on a topic. In order to understand the purpose of the subject’s strategy the operators which immediately followed *search* were examined. Table 6.16 shows the frequency with which other operators followed the operator *search*.

*Table 6.16 The frequency with which operators follow the operator search*

<table>
<thead>
<tr>
<th>Operator</th>
<th>Frequency of occurrence following <em>search</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>154</td>
</tr>
<tr>
<td>Action</td>
<td>30</td>
</tr>
<tr>
<td>Plan</td>
<td>16</td>
</tr>
<tr>
<td>Interpret</td>
<td>15</td>
</tr>
<tr>
<td>Observe</td>
<td>8</td>
</tr>
<tr>
<td>Inference</td>
<td>1</td>
</tr>
<tr>
<td>Reason</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 6.16 shows that the operator *search* is most likely to be followed by another *search* which confirms the finding that search is the operator that occurs most frequently in consecutive chains. It also suggests that *search* is used in a cumulative way to amass data on a given subject and build up a picture.

Once the search process has concluded the data collected during the study visits suggests it is most likely to be followed by *action*, rather than *inference*. However, table 6.7 showed that only 2% of verbalisations during the study visits depicted the operator *inference*. It was suggested earlier that this finding was a product of the naturalistic setting in which the data was collected. Data from the recall sessions confirmed the subjects were making inferences on the basis of the data they collected, indeed *inference* was the second most frequently occurring operator during the recall sessions (see table 6.9).
For subjects to take action or plan they must have reached a judgement about the state of the patient. Inference is therefore an implicit link between search and action and search and plan. In order to establish an explicit link between search and inference the visit data and recall data must be considered together. For example, in case two the nurse discussed the topic of breathing:

**TOPIC: BREATHING**
**INITIATOR:** Search > Search

From the visit protocol it would appear that the nurse asked two questions on this topic and then moved on to the next topic. However, the recall data that relates to this section of the visit shows that the nurse subject made an inference at this point: “He’s really still quite breathless.”

In case three the patient’s wife raises the topic of urinary elimination which leads the subject to undertake a search.

**TOPIC: ELIMINATION**
**INITIATOR:** Information from wife > Search

The topic appears to conclude at this point with the nurse moving on to the next topic. However, the recall data shows the subject made an inference at this point and gave her reason for this inference:

“I think it’s part and parcel of the disease `cos you get patches on the lungs and patches on the kidney and liver so I think it’s part of the disease and you get this hardening of the arteries. It’s the smooth muscle that goes, so I think that that is what it was.” (Subject 3)

Thus by considering the visit and recall protocols together it is possible to trace the sequence of cognitive operators more precisely and establish that subjects do make
inferences following search strategies, even though these are only implied in the visit data.

Examining the visits and recall protocols together also shows that search can be followed by two other operators: predict and interpret. The occurrence of predict is not surprising as it is applied to verbalisations that anticipate the future state or future behaviour of the patient. It is therefore similar to inference except that it is future orientated. Interpret is applied to verbalisations that indicate that the subject derived some meaning from the data but did not reach a judgement or conclusion in relation to the patient’s state or condition. It is similar to the conceptual operation of data-explanation identified by Hassebrock and Prietula (1992) and the process of pre-diagnostic interpretation described by Gale and Marsden (1985) as:

“an active interpretation of the clinical information available where the result of this activity is not sufficiently specific to constitute a possible diagnosis.”

The following extract from case 1 is an example of a situation where the search strategy led to a prediction. The extract from case 4 shows how the subject interpreted data but did not reach a conclusion about what state pertained.
### Case 1

<table>
<thead>
<tr>
<th>Source</th>
<th>Visit protocol</th>
<th>Visit protocol</th>
<th>Recall protocol</th>
<th>Recall protocol</th>
<th>Visit protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Search</td>
<td>Search</td>
<td>Predict</td>
<td>Plan</td>
<td>Search</td>
</tr>
<tr>
<td>Data</td>
<td>That's just a camp bed there is it?</td>
<td>Do you have trouble getting on and off?</td>
<td>He’s not going to be able to do that much longer</td>
<td>Something needs to be, I feel that we need to, perhaps something needs to be sorted out before he needs it.</td>
<td>If it was a bit higher do you think it would be easier?</td>
</tr>
</tbody>
</table>

### Case 4

<table>
<thead>
<tr>
<th>Source</th>
<th>Visit protocol</th>
<th>Recall protocol</th>
<th>Recall protocol</th>
<th>Recall protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Search</td>
<td>Observe</td>
<td>Observe</td>
<td>Interpret</td>
</tr>
<tr>
<td>Data</td>
<td>You’re going to see about your skin you told me yesterday?</td>
<td>He was bare [yesterday]. He has these patches there on his back</td>
<td>It wasn’t extensive, it was sort of in patches rather sort of dry, scabby looking.</td>
<td>Almost… I don’t know if you’ve ever seen scabies, it did look… but not in the right places, but that type of scabbing.</td>
</tr>
</tbody>
</table>
The extract from case 1 shows the operator sequence went from *search* to *predict*. The subject’s schema based knowledge of the progression of the patient’s illness enabled her to predict that he would no longer be able to roll on and off a camp bed as he was doing currently. Again, having identified the potential problem, the subject immediately begins to consider the solution. Indeed, her next *search* relates to planning the solution. This is further evidence that subjects’ schema contain knowledge about how to respond to a problem as well as how to identify it.

In case 4 the subject used the operators *search* and *observe* to interpret the data pertaining to the patient’s skin condition and identify conditions which it resembles. However, she does not reach a conclusion or a judgement about the exact state of the patient (*inference*). Her subsequent verbalisations are a further attempt to clarify the nature of the problem:

<table>
<thead>
<tr>
<th>Nurses verbalisations</th>
<th>Cognitive operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>You’ve had it ever since have you?</td>
<td>Search</td>
</tr>
<tr>
<td>And how long is it?</td>
<td>Search</td>
</tr>
<tr>
<td>I thought you were going [to the dermatologist] this week, is that not right?</td>
<td>Search</td>
</tr>
<tr>
<td>Is it giving you a problem, is it irritating as well?</td>
<td>Search</td>
</tr>
<tr>
<td>Have you had any creams for it?</td>
<td>Search</td>
</tr>
<tr>
<td>And is that no good?</td>
<td>Search</td>
</tr>
</tbody>
</table>

In conclusion the findings from this study suggest that in addition to a pattern of *search* and *inference* suggested by Baron’s (1994) search-inference framework, subjects’ search strategies can also be followed by the operators *predict* and *interpret*. Thus search may lead to an inference about the future state of the patient or to a level of interpretation that is insufficient for an inference to be made.
In terms of understanding how the subjects used operators to move through the problem space it was considered useful to examine which operators were used to open a topic and which operators concluded a topic. As noted previously three quarters of the topics (76%) were initiated by the nurse and a quarter (24%) by the patient or other person present during the visit. The opening cognitive operator was identified separately for topics that had been initiated by the nurse and topics that had been initiated by the patient. Table 6.17 shows the opening cognitive operator for topics which were raised by the patient or others present during the visit.

Table 6.17 The opening cognitive activity in topics initiated by patients or others

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Number of topics in which the operator opened an operator sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>20 61%</td>
</tr>
<tr>
<td>Action</td>
<td>8 24%</td>
</tr>
<tr>
<td>Plan</td>
<td>3 9%</td>
</tr>
<tr>
<td>Interpret</td>
<td>1 3%</td>
</tr>
<tr>
<td>Observe</td>
<td>1 3%</td>
</tr>
</tbody>
</table>

Table 6.17 shows that search is the operator most likely to start the operator sequence for a new topic. A further analysis of the visit data shows that when patients initiated a topic they did this either by giving a piece of unsolicited information or asking a question. A piece of information volunteered by the patient usually led the nurse to search for further data. A question from the patient was usually followed by the operator action as the nurse responded with advice or information.

The table below (6.18) show which operators start the sequence when the topic is initiated by the nurse.
Table 6.18 The opening cognitive activity in topics initiated by nurses

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Number of topics in which the operator opened an operator sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>95 68%</td>
</tr>
<tr>
<td>Plan</td>
<td>24 17%</td>
</tr>
<tr>
<td>Action</td>
<td>10 7%</td>
</tr>
<tr>
<td>Inference</td>
<td>4 3%</td>
</tr>
<tr>
<td>Interpret</td>
<td>4 3%</td>
</tr>
<tr>
<td>Observe</td>
<td>2 2%</td>
</tr>
</tbody>
</table>

Search is again the cognitive operator that is most likely to be used at the beginning of a topic. However, the position of action and plan are reversed when the topic is initiated by nurses. This is partly accounted for by nurses responding to patient’s questions with action during patient initiated topics. When nurses themselves initiate a topic it would appear they do so either to seek information on the topic (search) or to state how they intend to respond (plan).

The operator which concluded a topic was also identified for all the topics covered in the study visits. This was considered important because it indicates which cognitive operators enable the nurse to complete the problem solving process for a particular topic and move on to a new subject. Table 6.19 shows the frequency with which cognitive operators were used to conclude a topic.
Table 6.19 The concluding cognitive operator across all topics

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Number of topics where the operator concluded an operator sequence</th>
<th>Operator sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>87</td>
<td>50%</td>
</tr>
<tr>
<td>Action</td>
<td>32</td>
<td>18%</td>
</tr>
<tr>
<td>Plan</td>
<td>24</td>
<td>14%</td>
</tr>
<tr>
<td>Reason</td>
<td>12</td>
<td>7%</td>
</tr>
<tr>
<td>Interpret</td>
<td>10</td>
<td>6%</td>
</tr>
<tr>
<td>Inference</td>
<td>6</td>
<td>3%</td>
</tr>
<tr>
<td>Observe</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Read</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

*Search* is the operator which concludes a topic on half the occasions which, although less than the frequency with which it is used to open topics, is still high. This may be accounted for by the fact that, as previously shown, subjects did not verbalise the inferences and interpretations they were making at the time. Data from the recall sessions demonstrated that such interpretations and inferences were being made however, it is possible then that subjects interpreted the information they were given in response to the concluding *search* operator, or made an inference, which enabled them to conclude the topic and move on.

A further examination of occasions where *search* was the concluding operator showed that there were 28 occasions where *search* was the only operator for a particular topic. In other words the subject asked only one question within the topic and then moved on. In this case *search* was both the opening and concluding operator. This would suggest that the patient’s response to the *search* led the nurse to judge that this topic did not need to be pursued. As discussed previously, Baron (1994) asserts that thinking consists of search and inference. The thinker searches for objects and then make inferences from and about the objects found. In the field of clinical decision making the work of Gale and Marsden (1983) would suggest that the objects the
thinker is seeking are the forceful features which will activate existing mental representations of the patient’s condition. If the search does not yield any pertinent cues or forceful features the clinician will infer that no difficulties exist in that area and move to a new topic. There is further support for this view from Baron (1994) when he suggests that there must be something for the search to find if thinking is to succeed. Whether or not forceful features are found will depend not only on the data in the external environment but also on the individual subject’s ability to recognise forceful features which is, itself, dependent on their own knowledge structures.

6.3.4 Relationship between visit structure and cognitive operators

In chapter five the structure of an assessment visit was identified as consisting of three phases: an introductory phase, aimed at establishing a general picture of the patient, a working phase in which the patient’s nursing problems were identified and routine enquires were made, and a concluding phase which was characterised by discussion of the plan of care. The occurrence of cognitive operators was examined to see whether the use of particular operators was associated with a particular phase of the visit. The following series of tables shows the rank order of usage of the different cognitive operators during different phases of the visit.

Table 6.20 Introductory Phase: Rank order of usage of cognitive operators

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Frequency of use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>30</td>
<td>83%</td>
</tr>
<tr>
<td>Action</td>
<td>3</td>
<td>8%</td>
</tr>
<tr>
<td>Interpret</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>Inference</td>
<td>1</td>
<td>3%</td>
</tr>
</tbody>
</table>

From table 6.20 it can be seen that the introductory phase is dominated by the operator search which accounts for 83% of the verbalisations in that part of the visit. Only three other operators are used action, interpret and inference.
Table 6.21 Working Phase: Rank order to usage of cognitive operators

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Frequency of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>271</td>
</tr>
<tr>
<td>Action</td>
<td>120</td>
</tr>
<tr>
<td>Plan</td>
<td>67</td>
</tr>
<tr>
<td>Reason</td>
<td>31</td>
</tr>
<tr>
<td>Interpret</td>
<td>20</td>
</tr>
<tr>
<td>Observe</td>
<td>11</td>
</tr>
<tr>
<td>Inference</td>
<td>9</td>
</tr>
<tr>
<td>Read</td>
<td>2</td>
</tr>
<tr>
<td>Predict</td>
<td>1</td>
</tr>
</tbody>
</table>

During the working phase of the visit (table 6.21) all nine operators are used but search still accounts for 51% of the verbalisations. Action and plan rank second and third in the order of usage.

Table 6.22 Concluding Phase: Rank order of usage of cognitive operators

<table>
<thead>
<tr>
<th>Cognitive operator</th>
<th>Frequency of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>52</td>
</tr>
<tr>
<td>Action</td>
<td>29</td>
</tr>
<tr>
<td>Search</td>
<td>21</td>
</tr>
<tr>
<td>Reason</td>
<td>4</td>
</tr>
<tr>
<td>Interpret</td>
<td>2</td>
</tr>
<tr>
<td>Inference</td>
<td>2</td>
</tr>
<tr>
<td>Predict</td>
<td>1</td>
</tr>
<tr>
<td>Observe</td>
<td>1</td>
</tr>
</tbody>
</table>

In the concluding phase of the visit all the operators are used except for read. Plan now accounts for the majority of verbalisations with action ranking second and search now ranking third.

These findings support the conclusions drawn previously about the structure of assessment visits. The introductory phase is characterised by broad search strategies aimed at establishing a general impression of patients and identifying the parameters of their clinical condition. The working phase involves the nurse refining her
understanding of patient’s nursing problems so that she can offer appropriate advice and information to support the patient in managing his condition, and plan care. This view is supported by the fact that search continues to be the main operator used with action and plan ranking second and third. The concluding phase is characterised by discussion of the plan. This is borne out by the finding that plan is the dominant operator in this phase. The concluding phase is not as narrowly focused as the introductory phase as the majority of operators are found in this phase. Although superseded by action and plan, search continues to be used in this phase of the assessment accounting for 21 (18%) of the verbalisations. However, closer examination of the data suggests that in this phase of the assessment search is being used to collect data to support the planning of care rather than establishing the state of the patient. Frequently the nurse is confirming the patient’s agreement to the proposed plan. For example:

“Would you like me to have a word with the doctor about the cramps? (Visit 1)

“Do you want me to cancel your appointment? (Visit 2)

This further confirms the view that finalising and agreeing the plan of care are the dominant activities in the concluding phase of the visit.

6.4 DISCUSSION OF FINDINGS

It was identified that nine different cognitive operators were used by District Nurses during the assessment of patients. Search was found to be the dominant operator accounting for almost half the verbalisations during the study visits. Together search,
action and plan accounted for 85% of the verbalisations made during visits. Only 2% of verbalisations made during visits contained inferences.

When the recall data was examined a different picture emerged with inference accounting for 25% of verbalisations and reason being the most frequently occurring operator. The naturalistic setting of the study may be a factor here. It would appear that nurses do make inferences during the course of assessing patients but that they do not verbalise them in the context of the visit. There are two possible explanations for this; firstly that the state of the patient is obvious to both the patient and the nurse and therefore does not need verbalising and secondly that the nurse makes a conscious decision not to share her inference with the patient at that point.

This finding also shows the importance of the recall session in making explicit cognitive processes that would not be inferred from the data collected during the study visits alone. The naturalistic setting for this study meant that nurses were conducting the assessment task on real patients in the field. Given this context it is perhaps not surprising that the emphasis of cognitive activity during the visit is on search, action and plan. The recall sessions, however, yield data that reveal the rationale and inferences underpinning these activities. This emphasises the importance of the study design in obtaining a comprehensive picture of the cognitive strategies utilised by nurses in the course of assessing patients.

The analysis of cognitive operators used in different phases of the visit supported previous findings in relation to visit structure. The introductory phase, for example, was dominated by the operator search which accounted for over 80% of
verbalisations and characterised by short operator sequences. It was concluded that this supported the finding that the purpose of the introductory phase of the assessment visit is to establish the parameters of the patients' condition and get to know them as an individual. In a similar way during the concluding phase almost half the verbalisations were described by the operator *plan* confirming that this phase of the visit involves finalising and agreeing the plan of care. It was noted that the operator *search* had two functions: the collection of data to support the identification of the patient’s condition or state and the collection of data to support planning. *Search* tended to be used for the latter purpose during the concluding phase of the visit.

The analysis of operator sequences showed that some operators tended to occur in consecutive chains namely, *search*, *action* and *plan*. Of these *search* occurred most frequently in consecutive chains. It was suggested that this confirms the purpose of *search* as being the accumulation of data within a topic until an understanding of the patient’s state can be reached or an action or plan determined.

The tracing of the sequence of cognitive processes provided the richest data in terms of understanding how the subjects worked through the problem solving task. The findings show that the majority of new topics were initiated by the topic *search* (tables 6.17 and 6.18) and that the operator *search* was likely to be repeated several times. It is suggested that the data or evidence collected in response to the search transforms the subject’s knowledge state to enable one of three subsequent cognitive processes to occur: *inference*, *predict*, or *interpret*. These in turn give rise to the operators *action* or *plan*. An explanation for this is that nurse subjects’ knowledge is represented internally as schema which include identification, elaboration and
planning knowledge (Marshall 1995). Thus once a patient’s condition has been identified the nurse’s response in terms of action or plan is also contained within the schema.

The operator reason can occur in association with a number of other operators. During the visit subjects gave patients the reason for advice they were imparting and plans they were proposing. During the recall session, in addition, subjects gave reasons for their lines of enquiry, their inferences, and their interpretations. As such the operator reason does not, in itself, contribute to the solving process. However, it is important for eliciting data about how subjects are applying their knowledge to work through the problem solving task.

Within the context of this study, which was conducted in the clinical setting, the operators read and observe are other approaches to the collection of data and as such are perhaps best conceptualised as types of search.

From the findings of this study and the discussion above a model of clinical problem solving is proposed. It is suggested that the knowledge content of schema enable the identification of forceful features (Gale and Marsden) or triggering cues (Narayan and Corcoran-Perry 1997) within the data available which cause the schema to be activated. Once activated the schema guides the collection of further data. It also contains information about how to respond to the situation which leads to action and planning. The model shows the interrelationship between cognitive processes and subjects' knowledge as they work through the problem task. Ka presents the subject's knowledge state at the start of the problem solving process. Kz represents the
knowledge state at the conclusion of the process. Thus the model depicts the subjects’ Line or Reasoning (Hassebrock 1992, Narayan et al 1997).

**Figure 6.2 A Line of Reasoning for Clinical Problem Solving**

![Diagram of reasoning process]

In chapter five it was suggested that in order to obtain a comprehensive picture of an individual’s reasoning both the knowledge and the cognitive operators they utilise needed to be considered together. This examination shows how knowledge and reasoning processes integrate to move the individual through the problem space to the goal state. In chapter five a line of reasoning was compiled which showed the knowledge utilised by subject five (see page 235). This line of reasoning will be further developed to show the cognitive operators that were applied to transform the knowledge states as subject five worked through the problem space (see page 292).

First, however, the model can be considered in terms of Baron’s (1994) search-inference framework. He argued that the thinking is a process of searching for three kinds of objects: possibilities, evidence and goals. Within the context of nursing
assessment it could be argued that the overall goal is known. Indeed, Baron (1994) suggests that in diagnosis the goal is understood to be to discover what the trouble is or what is wrong with the patient. In chapter five it was suggested that the purpose of nursing assessment is to determine the state or condition of the patient as a consequence of his medical diagnosis. However, it could be argued that this overarching goal is not specific enough to help the subject work through the problem solving task. The introductory phase of assessment is characterised by broad, general questions aimed at defining the parameters of the patient's condition. It is suggested that this process helps to establish the sub goals of the task. These are the topics or the phenomenon which the nurse identifies as pertinent or relevant in the given clinical scenario and which must be worked through in order to establish whether problems exist which may be amenable to nursing intervention.

The "possibilities" which nurses seek are represented by the schema contained in long term memory. These schema are internal representations of knowledge which identify what possible state may pertain and what action should be taken in response. In chapter five it was suggested that subjects had developed schema in relation to clinical, although not necessarily medical diagnostic, phenomena and personal phenomena.

In this model "evidence" refers to the data collected which enables the nurse to confirm whether the schema she has activated is correct, in other words whether her hypothesis about the patient's condition has been proved. The collection of data thus leads to the activation of a schema which in turn determines what further data should be collected. The outcome of this process in Baron's (1994) framework is inference
or the use of evidence so that each "possibility" or schema is strengthened or weakened as a choice in the light of the available evidence. In this model the outcome of the process can be inference or prediction, which equates to a future based inference.

*Interpret* was also found to be an outcome of the search process in this study. It is suggested that subjects are able to make only preliminary interpretations of the data in situations where either they do not have enough data available to make an inference, or they do not have a well developed schema that matches their clinical findings. Thus subject four in the extract on page 274 could only interpret the patient’s skin condition as analogous to scabies, but not scabies. However, sometimes interpret occurred as an antecedent to an inference. Thus having derived meaning from the data the subject could proceed to infer what state pertained. On other occasions interpret led to a further data search. The individual interpreted the data available and this interpretation directed the search for further data in the same way as the operator inference was found to guide subsequent data collection. Again it was found that like the operation inference the operator interpret enabled subjects to take action and make plans. Thus, although it represents a lower level of interpretation of the data than inference, this operator is like inference in that it leads to a further search, action or plan which explains its position in the model.

In section 6.3.1 it was suggested that the distinction between the operators interpret and inference may not always be clear. The discussion above has highlighted the similarities in the characteristics of the two operators and it has been suggested that interpret represents a lower level interpretation of the data than inference. It may
therefore be more appropriate to consider the categories interpret and inference as both depicting examples of inference but at different levels. Hammond's inference model of diagnostic judgement (Hammond 1996) provides a useful way of distinguishing different levels of inference and is depicted in figure 6.3.

Figure 6.3 an inference model of diagnostic judgement (Hammond 1996)

Hammond (1996) suggests that the state of the patient is depicted by "multiple fallible indicators" such as signs and symptoms and the patient's history. The clinician is required to make some judgement of these indicators. Because these indicators are multiple the clinician must integrate or organise them into a usable form so that a conclusion or diagnosis of the patient's condition may be reached. It would appear that the initial judgement of the indicators requires a process of evaluation or interpretation based on prior knowledge. This could be considered as a first level inference. Next the clinician is required to integrate the factors into a usable form.

There are parallels here with the ideas of pattern building (Gale and Marsden 1983, Barrows and Feltovich 1987) and Eddy and Clanton's (1982) view that physicians
group elementary findings into sets known as aggregate findings. This activity could be considered as a second level inference. Finally a judgement or diagnosis can be reached based on the integrated cues or factors. This would equate with the idea of diagnosis as a form of pattern recognition. Indeed Hammond's Cognitive Continuum Theory (Hammond 1988) is based on the premise that cognition is capable of relying on pattern recognition which is dependent on the individual's prior learning and experience (Cooksey 1996).

In this study nurse subjects were also found to make predictions or future based inferences. Hammond (1988) suggests that predictions require the use of functional relations to interpret the presenting data. He suggests that making predictions involves high order cognitive processes which can apply functional rules and extrapolate trends. Examples of both pattern recognition and the use of functional relations have been found in the second study. For example, nurse subject one attended to the cues dropped toe and loss of motor control and used pattern recognition to retrieve a schema for Motor Neurone Disease. Later she predicted a possible difficulty with constipation due to the patient's reduced mobility. This prediction relied on an understanding of the functional relationship of the construct mobility to the construct constipation. Like Bordage et al (1990), Hammond emphasises the requirements for a flexible approach and the need to alternate between pattern recognition and the use of functional relations according to the demands of the task. To conclude the discussion on the operators interpret and inference it is suggested that inference can occur at a number of levels from an initial interpretation of individual cues, to a judgement or diagnosis of the nursing problems, to a predictive judgement of what problems may occur in the future. Thus in the model of a line of reasoning proposed in this thesis interpret and predict are shown as a types
of inference in the same way that read and observe were considered to be types of search.

Narayan et al (1997) identify a number of structural components within lines of reasoning and it is important to consider these in the light of the model of the line of reasoning proposed here. The components consist of: triggering cues, domain concepts, intermediate conclusions, intermediate actions and a conclusion. Narayan et al (1997) describe triggering cues as data that activates one or more concepts in long term memory. The constraints of short term memory mean that individuals can only attend selectively to salient cues within the whole range of data available. As such, triggering cues would equate to forceful features (Gale and Marsden 1987).

Domain concepts are defined by Narayan et al (1977) as organised mental representations of knowledge relevant to the task. It is suggested by the authors that once activated they become the focus of attention in short term memory. It is proposed that domain concepts equate with the phenomena or concepts around which schema are organised. Once activated schema give direction to those items of data that are focused on in short term memory.

Intermediate conclusions are described by Narayan et al (1997) as conditional judgements that something must be done before desired actions can be taken or intended outcomes achieved. The idea of conditional judgements appears to equate with Baron's idea of "possibilities". Thus the activation of a schema leads the individual to consider the possibility that a particular clinical state may pertain, a conclusion to this effect is conditional on the collection of further evidence. A directed data search must ensue in order to achieve the outcome, or meet the goal, of
determining the patient's clinical condition. In terms of the operators described in this study intermediate conclusions equate to lower order inferences, discussed above, that are insufficient for a final judgement to be reached. According to Narayan et al's (1997) definition intermediate actions are those activities that the nurse mentally generates and which, if carried out successfully would remove the barrier to the desired action or intended outcome. In the model proposed here the intermediate action is the collection of further data or evidence which may be used to infer whether the presenting situation matches the activated schema. Finally Narayan et al (1997) describe a LOR conclusion as the judgement at the end of the process. This would equate to the processes of inference and predict in the model described here. It has been found that the contents of subjects' schema include knowledge about how to respond to the clinical situation and so nature of the problem and interventions are considered concurrently. Thus the processes of inference, predict and even interpret lead to action and planning in this model.

The line of reasoning commenced in chapter five (figure 5.4) can now be completed by the addition of the cognitive operators which transformed the subject's knowledge states as she moved through the problem space.
Figure 6.4 Line of reasoning in relation to urinary elimination (case five)

<table>
<thead>
<tr>
<th>Operator</th>
<th>Data</th>
<th>Knowledge State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering cue:</td>
<td>Nocturnal pattern of urinary elimination</td>
<td>K1</td>
</tr>
<tr>
<td>Schema activated:</td>
<td>Incontinence: ? due to infection, ? due to low fluid intake</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>Do you have problems during the day as well as during the night?</td>
<td>K2</td>
</tr>
<tr>
<td>Search</td>
<td>How many times at night do you have to get up?</td>
<td>K3</td>
</tr>
<tr>
<td>Search</td>
<td>How many times during the day?</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>Every six hours or every ten minutes?</td>
<td>K4</td>
</tr>
<tr>
<td>Schema activated:</td>
<td>Urgency incontinence</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>Do you get an urgency after you have decided to go?</td>
<td>K5</td>
</tr>
<tr>
<td>Schema activated:</td>
<td>Incontinence due to infection. Diabetes leading to increased urinary output</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>How much do you drink?</td>
<td>K6</td>
</tr>
<tr>
<td>Inference</td>
<td>Incontinence due to infection</td>
<td></td>
</tr>
<tr>
<td>Plan</td>
<td>Send off urine specimen</td>
<td></td>
</tr>
<tr>
<td>Triggering cue:</td>
<td>(volunteered by daughter) prolapsed uterus</td>
<td>K7</td>
</tr>
<tr>
<td>Schema activated:</td>
<td>Incontinence due to prolapse</td>
<td></td>
</tr>
<tr>
<td>Plan</td>
<td>Check medical notes. If specimen clear, ring continence clinic ? needs a ring pessary.</td>
<td></td>
</tr>
<tr>
<td>Interpret</td>
<td>So you don’t drink very much then</td>
<td></td>
</tr>
<tr>
<td>Schema activated:</td>
<td>Dehydration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Search</td>
<td>Do you have trouble with your skin at all, does your skin get dry?</td>
<td>K8</td>
</tr>
<tr>
<td>Search</td>
<td>On your shins?</td>
<td>K9</td>
</tr>
<tr>
<td>Search</td>
<td>Do you have a dry mouth?</td>
<td>K10</td>
</tr>
<tr>
<td>Plan</td>
<td>Provide pads whilst identifying the underlying cause of incontinence</td>
<td></td>
</tr>
</tbody>
</table>

It is useful to consider this line of reasoning in terms of the structural components identified by Narayan et al (1997). The triggering cue for this line of reasoning was the nocturnal pattern of urinary elimination the patient had described. It can be seen that halfway through the line of reasoning it appeared that the subject had concluded or inferred that the patient was incontinent due to an infection and she planned to send
off a specimen of urine for analysis. Having reached this position a second triggering
cue (prolapsed uterus) was presented which led to further problem solving.

The domain concepts that were relevant to this task and around which schema were
organised were: incontinence, dehydration, and diabetes. Activating these schema led
the subject to reach conditional judgements (Narayan 1977) or consider possibilities
(Baron 1994). The possibilities considered were: Incontinence due to infection
caused by low fluid intake, urgency incontinence, incontinence due to a prolapse,
diabetes and dehydration. These possibilities led to the search for evidence. The data
collected added to the subjects knowledge and each new piece of information
transformed the subject's knowledge state.

The intermediate actions taken in this line of reasoning were searches for further data
to achieve the desired outcome of understanding the cause of the patient's
incontinence so that appropriate intervention could be planned. In addition the subject
made plans to collect data that was not available in the clinical situation such as the
results of urinalysis and the contents of the medical notes. Plans for a possible
referral (to the continence clinic) and possible intervention (insertion of a ring
pessary) were also made.

Interestingly this line of reasoning does not achieve the overall goal of determining
the cause of the patient's incontinence. At the conclusion two possibilities remain:
incontinence due to infection and incontinence due to prolapsed uterus. However, the
subject has collected enough information to formulate a plan to manage the clinical
problem whilst collecting further data to establish its cause.
According to Information Processing Theory the problem solving task starts with the initial or problem state and ends when a solution is reached – the goal state. It is suggested that the individual moves through the problem space by applying operators to transform the initial state into intermediate knowledge state(s) until the goal state is achieved. Table 6.23 shows how subject five started with the problem state of an abnormal pattern of nocturnal urinary elimination. The goal state was to have an understanding of the cause of this condition and a plan of appropriate intervention. Ten new knowledge states were achieved between the initial state and the solution. Table 6.23 shows the contents of these knowledge states.

Table 6.23 Knowledge states achieved during problem solving in relation to urinary elimination

<table>
<thead>
<tr>
<th>Knowledge state</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>Frequency of urination at night</td>
</tr>
<tr>
<td>K2</td>
<td>Frequency of urination during the day</td>
</tr>
<tr>
<td>K3</td>
<td>Urinates three times at night</td>
</tr>
<tr>
<td>K4</td>
<td>Urinates two hourly during the day</td>
</tr>
<tr>
<td>K5</td>
<td>No urgency, therefore not urgency incontinence</td>
</tr>
<tr>
<td>K6</td>
<td>Low fluid intake</td>
</tr>
<tr>
<td>K7</td>
<td>History of prolapse</td>
</tr>
<tr>
<td>K8</td>
<td>Has dry skin</td>
</tr>
<tr>
<td>K9</td>
<td>Not on shins particularly</td>
</tr>
<tr>
<td>K10</td>
<td>No dry mouth</td>
</tr>
</tbody>
</table>

The line of reasoning (figure 6.4) and analysis of knowledge states (table 6.23) show how the subject uses the operator search to accumulate information and thus transform knowledge states within the problem space. Information within the presenting situation is combined with knowledge stored in long term memory as schema. Identification knowledge (Marshall 1995) enables the schema to be activated and once activated it contains elaboration knowledge (Marshall 1995) which guides
the subsequent search for data until an inference can be made. The schema also contain planning knowledge (Marshall 1995) which enables the subject to plan their response to the presenting situation. The line of reasoning thus shows how subjects apply cognitive operators to process information in the clinical setting and integrate it with knowledge stored in long term memory during the assessment task.

6.5 SUMMARY

The third aim of the study described in chapter five was to identify the cognitive operators used by District Nurses during the assessment of patients. The results presented in this chapter show how nine cognitive operators were identified: read, search, interpret, inference, predict, reason, plan, action and observe. During the discussion it was suggested that within the context of this study the operators read and observe should be considered as types of search. The operators interpret and predict were considered to be more appropriately conceptualised as types of inference. The operator reason was found to be important in eliciting an understanding to the subject’s rationale for the application of other operators but it did not, itself, contribute to the problem solving process. This therefore left four operators which were considered to depict the essential cognitive processes subjects used during the assessment task.

It was suggested that to understand the clinical reasoning process three elements needed to be considered together: the knowledge utilised by subjects, the cognitive processes applied and the underlying architecture of the human mind. In chapter one the theoretical framework for the study was described as being derived from Information Processing Theory. This theory is based on the premise that the capacity
of short term memory is limited and therefore only a small amount of information can be attended to, creating a requirement for the individual to recognise and extract salient pieces of data from the array of information presented. These pieces of data act as keys to unlock knowledge stored in long term memory in cohesive structures. Thus the constraints of short term memory necessitate the effective organisation and structuring of knowledge so that salient information in the presenting situation can be recognised and used to retrieve salient information from long term memory.

In chapter five the content and structure of District Nurses knowledge was examined. It was suggested that subjects attended to a range of clinical and personal phenomena and that knowledge relating to these phenomena is organised as schema in long term memory. Chapter six describes the cognitive operators subjects apply to elicit new data and integrate it with information stored in long term memory until a conclusion is reached about the patients’ condition and what the appropriate response should be. A line of reasoning for clinical problem solving was proposed which showed how subjects combine knowledge and cognitive processes in clinical problem solving.

In chapter seven the methodological approach used in the two studies described in the thesis will be reviewed, the implications of the findings for nursing practice will be considered and suggests for further research made.
CHAPTER SEVEN

DISCUSSION AND CONCLUSIONS

7.0 INTRODUCTION

This thesis reports on two studies which reflect the development in thinking in relation to clinical decision making in recent years. In line with early thinking that there must be a problem solving process common to all problem situations (Elstein et al 1978) the first study, described in chapter three, sought evidence of hypothetico-deductive reasoning. Whilst some evidence of hypothetico deductive reasoning was found it accounted for only some of the activities the nurse subjects engaged in during the assessment task. The nurse’s knowledge, either of the clinical phenomena that the patient was presenting with, or of the patient themselves, appeared to have an important role in underpinning the problem solving process.

Some evidence was also found that the structure of visits varied, based on the referral information.

A subsequent review of the literature, reported in chapter four, suggested that a well organised knowledge base that could be rapidly retrieved was essential for successful problem solving. The internal representation and organisation of knowledge is one of the characteristics that distinguishes novices from experts. The second study therefore examined the content of the assessment visits, in terms of the topics covered, in order to elucidate the knowledge utilised by District Nurses. A process modelling approach (Harte 1994) was used to identify and describe the cognitive operators used in the course of assessing patients. By focusing on both the topics covered and the cognitive operators used during the assessment visit the study was
able to highlight the interplay between cognitive processes and the organisation of knowledge in memory.

Nurse subjects were also found to use a complex operator for structuring the assessment task. Two different structures to assessment visits were found and the main basis of variation was found to be the requirement for a physical nursing task to be carried out which was identified at the time of referral.

In this final chapter the methodological approach used in the two studies, and in particular the naturalistic setting for the collection of data, is discussed and its contribution to the elicitation of the findings is considered. Further consideration is given to the evidence found of the importance of knowledge reasoning integration in clinical problem solving. The type of knowledge utilised by nurses is discussed in terms of clinical phenomena and knowledge of the patient as an individual. The importance of understanding how subjects combine the utilisation of knowledge with the application of cognitive operators to solve problems is highlighted.

The implications of the study findings for professional practice are considered, particularly whether effective clinical problem solving can be taught. The use of the nursing process within the context of clinical problem solving is also discussed. Key values and concepts in nursing, such as the holistic approach and individualised care, are reviewed in the light of the study findings. Recommendations for further research in the field of clinical decision making are made. Finally the conclusions of the study are identified.
7.1 DISCUSSION OF THE METHODOLOGICAL APPROACH EMPLOYED IN THE TWO STUDIES

The decision to conduct the study in the naturalistic setting was an important one because it had a number of subsequent implications for the research design. The choice of the naturalistic setting was made because the study of clinical decision making in nursing was relatively new and, with the exception of the study described earlier undertaken by Luker and Kenrick (1992), there have been no studies undertaken specifically of District Nurse's clinical decision making. It was considered that there were a number of variables in the community setting which were of greater significance when identifying the patient's requirements for care than in the hospital setting, such as the home environment and the contribution of others to the care of the patient. In order to capture the full flavour of the District Nursing ecology the decision was made to conduct the study in the field. It was acknowledged that this approach may provide the data from which simulations for subsequent studies could be designed.

Support for this approach comes from the naturalistic decision making movement. In Chapter Two it was argued that clinical decision making represents an example of naturalistic decision making (NDM) (Orassanu and Connolly 1993). The focus of research in this area has been on how decisions are made in complex, real world environments. The Recognition Primed Decision model developed by Klein (1993) describes not just how subjects identify what problems pertain within the task environment but also the decision to act. The model has been applied and tested in a number of field settings such as battle planning, fireground command and aircrew coordination. Cannon-Bowers et al (1996) note that a paradigm shift has occurred in the study of human decision making with researchers now more concerned about
understanding decision making as it occurs in the real world under naturalistic conditions. As a result NDM researchers have largely rejected the notion of laboratory studies in favour of the field settings.

Evidence that this approach is gaining ground in the study of clinical decision making in nursing comes from the increased emphasis on ecological validity (Lamond et al 1995). Researchers such as Fonteyn et al (1993), Watson (1994) and Hagedorn (1996) have all conducted their studies of clinical decision making in the clinical setting.

The methodological approach to data collection used in the two studies described here was process tracing. This involves subjects giving verbal reports of their thinking during a problem solving task. The two methods of eliciting verbal reports were identified as concurrent and retrospective. The possible disadvantage of concurrent reporting is that the act of thinking aloud distorts the subject’s cognitive processes which are the object of measurement. However, retrospective reports are criticised for the possibility that subjects will not accurately recall their thought processes because of the time lapse between the task and the reporting of their thinking which may lead to post hoc rationalisations of their thought processes. Bowers and Snyder (1990) suggest that the debate should shift away from the notion that one type of protocol is always good and the other always bad. Instead the type of protocol to be used should be selected on the basis of the research question to be addressed. In their study Bowers and Snyder (1990) compared the use of concurrent and retrospective protocols during a problem solving task. Their findings suggest that there is a qualitative difference in the type of data each report elicits. Concurrent reports give
relatively low level verbalisations because subjects appear to be attending to the experimental task and thus give little thought to the comments they are making. Retrospective subjects can give their full attention to reporting their thinking and thus give richer information characterised by explanation of their thinking. Bowers and Snyder (1990) therefore suggest that if the research question concerns explanation and design issues in relation to problem solving retrospective verbal protocols are the method of choice.

The decision to conduct these studies in the clinical setting meant that retrospective reports had to be used as the means of eliciting data from the subjects about their thinking. However, as the purpose of the study was to understand the cognitive processes nurses used and how they structured the assessment task this was entirely appropriate. A further point is that the recall sessions in which subjects reported their thinking was not the only source of data about their thinking. The visit protocols also provided evidence of their search strategies and the outcome of their thinking in terms of action and planing. Collecting data during the problem solving task and following this with a heavily cued or stimulated recall session enabled cross referencing between what happened in practice and what the subjects reported. Ericsson and Crutcher (1991) suggest that it is critical to use methods to produce data that can be validated by other means. It is important to be able to demonstrate that thought sequences are consistent with other observations on the same cognitive processes. The research design of the two studies reported here enabled such consistency to be demonstrated.
The approach taken also enabled a comprehensive picture of the cognitive processes utilised by nurses to be captured. Thus the visit protocols largely yielded evidence of the operators relating to search, action and plan, whilst the recall protocols yielded evidence of the inferences subject activated during the assessment task and, in line with the findings of Bower and Snyder (1990), the reasons for these and other cognitive activities.

The methods used to ensure validity and reliability were outlined in previous chapters. The verbal data met the criteria identified by Ericsson and Simon (1993) as being necessary conditions to be satisfied if data are to be used to infer underlying processes: the relevance, consistency and memory criterion. Evidence was also presented to show that the visits observed were typical of the nurses' usual practice and that their performance had not been significantly affected by the presence of the researcher or the tape recorder.

The issue of reliability largely relates to the method of data analysis: content analysis. Two measures of inter-rate reliability were used and the results, described in chapters three and five, enabled the finding of these studies to be considered reliable.

One possible criticism of these studies relates to the sample size. However, as has been shown, studies using this approach typically have small samples (Kuipers and Kassirer 1984, Carroll and Johnson 1990, and Fonteyn et al 1993). The conclusions drawn are based on the findings of two studies which represent a total of thirteen study visits. In addition to the number of visits observed, the length of the visits must be taken into account. In the first study visits lasted between 30 minutes and one hour.
whilst in the second study each visit typically took one hour or more which yielded a large quantity of data. Each visit was characterised by the nurse working through a number of topics which it has been suggested represent subgoals of the overall assessment task (Baron 1994). Thus each topic covered represented a discrete problem solving episode in its own right. Within the second study alone 70 topics were identified. Thus whilst the number of subjects in the sample was small, characteristic of this type of methodological approach, the number of problem solving instances observed and analysed was considerable.

In conclusion then, the methodological approach used was shown to be a valid and reliable way to study clinical decision making District Nurses. The naturalistic setting enabled an accurate picture of the type of cognitive operators used and the frequency with which they are employed to be obtained. Studying the assessment process in the field also enabled the topics covered by nurses to be identified empirically and compared with other similar studies (Luker and Kenrick, Spicer 1993, Crow et al 1996).

7.2 THE INTEGRATION OF KNOWLEDGE AND REASONING

At the outset the thesis was that problem solving in nursing could be explained by a model of hypothetico-deductive reasoning (Elstein 1978). This model described clinical reasoning in terms of the process the clinician used during problem solving. It was therefore postulated that nurses would engage in cue acquisition, and then generate a hypothesis about what the patient’s nursing problem might be. This hypothesis would guide the search for subsequent data until the hypothesis could be confirmed or ruled out.
The findings of study one showed that nurses did indeed activate hypotheses and seek to confirm them by collecting further data. The hypotheses they generated consisted of suppositions about what the patient's nursing problems might be and these suppositions or possibilities (Baron 1994) provided the basis for further reasoning. However, the hypothetico-deductive model could not explain how nurses recognised cues within the clinical environment as salient, nor could it account for how nurses interpreted these cues and activated hypotheses initially. Knowledge which enables salient cues to be identified and information to be interpreted was found to underpin the assessment process. It also provided the basis for determining what subsequent data should be collected. The hypothetico-deductive reasoning model provided an account of the reasoning process but did not make explicit the essential role of knowledge in successful problem solving. The findings of the first study showed that an account of clinical reasoning needs to embrace more than the process of reasoning and include the information the subjects reason with. If clinical reasoning could be accounted for by a generic problem solving process, this process would be applied universally in all situations with the same degree of success. The findings in relation to case specificity (Elstein 1978, Norman and Tugwell 1982, Gale and Marsden 1983) confirm that domain specific knowledge is essential for successful problem solving.

The second study provided evidence of the content and structure of nurses' knowledge. Knowledge was found to be organised as schema that included identification knowledge, elaboration and planning knowledge (Marshall 1995). It was shown that nurses have schema for organising knowledge in relation to clinical constructs and person schema (Augoustinos and Innes 1990) which enable them to make inferences about the type of person the patient is and their behaviour. Evidence
of schema provides an explanation of how nurses recognise which cues are pertinent in the clinical situation. Identification knowledge enables nurses to recognise relevant information and activate a schema which suggests possible nursing problem(s). Elaboration knowledge enables the nurse to determine what further data should be collected in order to confirm that the presenting clinical situation matches the activated schema. Planning knowledge provides the basis for predictive judgements about the patient's future nursing problems and therefore the future requirements for nursing care. This type of knowledge also provides an explanation of the nursing problem. Nurses' knowledge is organised so that treatment solutions are stored within schema as part of planning knowledge. Thus once a schema has been confirmed the appropriate nursing intervention is also activated.

The content of nurses' knowledge was considered in terms of the phenomena on which they focus. The results showed that nurses focused on both clinical and personal phenomena and that they used their understanding of the patient to individualise the plan of nursing care. Subjects were found to consider schema suggested plans, such as the provision of a sheepskin to prevent pressure sores, and then modify these proposals in the light of personal phenomena, such as the patient's response to his deterioration. Thus it would appear that subjects attend to both personal and clinical cues, interpret them and combine them to reach inferences about the state of the patient and plan care.

In chapter five it was suggested that it was possible to consider a "hierarchy" of phenomena. At the lowest level are the individual cues that nurse attend to. These cues are then combined and integrated to make inferences about the state of the
patient at a greater level of abstraction. Thus the nurse considers clinical constructs such as immobility and incontinence. It is suggested that it is clinical constructs at this level around which schema are organised. It was shown that nurse subject five in the second study, for example, had a schema organised around the construct of incontinence which included knowledge about how to identify incontinence, possible causes, and options for further intervention and management. It is possible that nurses’ schema are organised around clinical states or attributes in this way because their purpose is to provide intervention at an individual level that will alleviate such conditions. However, it is noted that nurses also have schema constructed around medical diagnoses such as Motor Neurone Disease and diabetes. The relationship of these schema and schema organised around clinical constructs will be discussed further.

Finally it is suggested that nurses may aggregate or combine inferences about a number of clinical states or attributes to make a global judgement about the patient’s requirement for care (as opposed to a specific plan of intervention). At this level the concepts that appear relevant are dependency, severity or illness, and duration of illness. Thus the nurse may infer from the state of the patient that he is self caring and will require short term care or conversely that he will be increasingly dependent, require total care and be a long term patient. Further work is needed to identify the constructs nurses have at this level of conceptualisation. However, it is suggested that the categorisation of patients at this level contributes to the management of groups of patients such as a caseload or a ward. Knowing their dependency and the severity of their conditions will enable decisions to be made about which patients are a priority and which require highly skilled intervention, for example. Indeed patient classification systems or patient dependency systems seek to group patients using
such global judgements so that decisions can be made about the allocation of nursing resources. The following figure represents the proposed hierarchy of phenomena with examples of some of the cues, clinical and care constructs from case one, study two.

Figure 7.1 the hierarchy of phenomena in nursing

The second study identified four key cognitive processes: search, inference, action and plan. It was also suggested that the way nurses structured the assessment into three distinct phases represented an example of a complex operator or metacognitive strategy for structuring the problem solving task. The introductory phase served to provide the context for problem solving in the working phase and delineate the parameters of the patient's condition so that the task was reduced to a manageable size and thus reduce cognitive strain.

A line of reasoning (figure 6.2) was developed to show how nurses combine cognitive processes and knowledge in clinical problem solving. Progress through the problem
space is made by nurses using knowledge to interpret cues and identify salient information. Pertinent information is used to make inferences at various levels from an initial interpretation of the data to an inference about a possible nursing problem. Nurses’ knowledge is organised as schema depicting patient states or attributes relating to clinical and personal phenomena. Thus once a schema is activated the nurse uses elaboration knowledge to direct the search for further data until the schema is confirmed.

This model has some parallels with the model of hypothetico-deductive reasoning originally considered. The concept of a diagnostic hypothesis has been replaced by the activation of a schema. Like a hypothesis this represents a possibility or supposition about what nursing problems the patient may have which provides the basis for further data collection. However, the line of reasoning developed in this thesis demonstrates the integration of knowledge with reasoning processes and thus accounts for how salient cues are recognised, how schema are activated and how planning solutions are rapidly formulated.

The contribution of the two studies described here has been to begin to identify the content of nurses knowledge, in terms of clinical and personal phenomena, and the organisation of knowledge, in terms of schema, for the domain of District Nursing. Clinical phenomena relate to the clinical condition of the patient which could include their medical diagnosis as well as other clinical concepts that are consequences of a patient’s medical condition such as immobility or pain. Lamond (1988) reached a similar conclusion when she proposed that in acute medicine and surgery nurses' schema are organised according to the patient’s medical diagnosis or surgical
procedure. However, she makes the point that the knowledge schemas she identifies are context specific and therefore may not be appropriate for nurses working in other specialities. It is important, then, to consider the contextual differences that might apply to the District Nurses in this study.

In her investigation of the nursing problems of patients in hospital and patients in the community Spicer (1993) found that the venue for care was the strongest predictor of a nursing problem. Patients in the community were found to have medical diagnoses that were categorised by subjects in Spicer’s (1993) study as “long term-chronic” and “long term – severely disabling.” It is suggested that hospital patients are admitted to hospital by virtue of their requirement for medical or surgical intervention. Their medical diagnosis may therefore assume greater importance and be a more critical predictor of the requirements for nursing care. By way of contrast, the nursing care of long term patients in the community is likely to be determined by their condition or state at a given point along the health illness continuum. (However, their medical diagnosis remains important for indicating the types of nursing problems they may have and predicting the course of their illness).

Spicer (1993) too suggests that nurses have a medically oriented construct system. However, she also notes that nurses spontaneously label problems at the lower level of concept formation, in other words the detail of the problem is made explicit. The focus of nursing appears to be the consequences (in physical, psychological and social terms) for the patient of his medical diagnosis. Thus it is suggested that whilst nurses do have schema constructed around medical diagnosis these will serve as “signposts” to other schema which are constructed around patient states such as pain, immobility,
incontinence, or anxiety which may be a consequence of a particular diagnosis. Indeed Marshall (1995) suggests that the planning knowledge stored in a schema will contain a set of expectations that enable the individual to predict future events. It is through this mechanism that nurses are able to anticipate patient's problems. In the schema for Motor Neurone Disease (figure 5.3) the subject's elaboration knowledge created expectations of nursing problems and plans for their solution (planning knowledge). However, it is suggested that the knowledge used to formulate these plans was not drawn from the Motor Neurone Disease schema and that the nurse probably had other schema constructed around the concepts of immobility, pressure sores, constipation and dysphagia. These schema would themselves contain knowledge relating to the aetiology and treatment of these conditions. Thus the medical diagnostic schema has an important role in activating a range of other schema that relate to patient states or conditions that are likely to be a consequence of the diagnosis and thus the focus of nursing intervention.

7.3 IMPLICATIONS OF THE STUDY FINDINGS FOR NURSING PRACTICE

7.3.1 Teaching clinical problem solving

From the discussion above the competencies associated with problem solving ability can be described as knowledge of domain content, the organisation and structuring of knowledge which enables effective representation of the problem, and the effective used of cognitive and metacognitive strategies. The findings of the studies described in this thesis suggest that nurses' knowledge content can be described in terms of phenomena that depict the patient's response to his medical condition. Their knowledge base also includes appropriate responses to identified problems in terms of nursing intervention. Shaw and Wilson (1976) propose that the ability to formulate abstract concepts underpins the acquisition of knowledge and this implies that
learners should have direct experience with exemplary instances of clinical and personal phenomena in the clinical setting. Repeated exposure to these phenomena will facilitate the organisation of knowledge into schema.

Studies relating to learning and teaching problem solving consistently suggest that learning occurs best through directly engaging in a problem solving task and is a product of repeated practice. Thus Shaw and Wilson (1976) identify direct experience with exemplary instances as important for concept formation, Frederiksen (1984) identifies the opportunity for practice as critical for developing pattern recognition, Egan and Greeno (1973) suggest learning by discovery rather than rule facilitates the development of well integrated cognitive structures, and Greeno (1980) also considers that discovery methods will lead to the development of generalisable problem solving strategies. The implication of these findings for nursing is that clinical problem solving is best learned in the practice setting through repeated exposure to clinical problems. Indeed this view is supported by Crow and Spicer (1995) who suggest that nursing judgement is based on a well developed process of categorisation which is acquired through clinical experience. They suggested that this accounts for the idea that expertise is embedded in clinical practice. Evidence from the field of cognitive psychology suggests that providing practice with feedback represents an effective approach to teaching problem solving. Glaser (1979) points out the extent to which training and practice are required to attain high levels of competence in complex cognitive activities. A study by Jacobs and Dominowsky (1981) demonstrates the value of feedback. They gave seven problems to 56 students with no instructions but indicated why incorrect answers were wrong and provided the
solution to those who failed to solve the problem with fifteen minutes. They found that after several attempts the subjects' solution times improved.

The goals of nursing education, then, should be to convey content knowledge, relevant to the domain of nursing, which focus on the clinical and personal consequences of an individual's health status; to convey knowledge in such a way that facilitates the organisation of knowledge into schema which contain identification knowledge, elaboration knowledge and planning knowledge; and to promote the acquisition of problem solving skills through practice in clinical problem solving accompanied by feedback. The refinement of knowledge structures continues as long as the individual is engaged in problem solving within a domain. This would suggest that activities such as clinical supervision and reflective practice have a role in continuing to enhance the clinical reasoning skills of even expert practitioners. Corcoran-Perry and Narayan (1995) suggest that reflection is a strategy that promotes thinking about a particular situation in relation to the environment in which it occurs, the feelings experienced, the judgements made and the actions taken. In this way the theoretical knowledge and reasoning processes implicit in clinical practice can be delineated, elaborated and transformed for future practice (Harris 1993). Experience, then, becomes more than the mere passage of time but represents a continual, active process of acquiring new knowledge, integrating it with existing knowledge and enhancing clinical reasoning skills.
This thesis started with a review of the nursing process and identified the potential for confusion between the process of problem solving described by cognitive psychologists and the description of the nursing process as a problem solving process. The introduction of the nursing process was important for emphasising the cognitive component of clinical nursing. However, it does not provide an adequate representation of how nurses solve clinical problems. The stages of data gathering in order to identify problems, planning implementation and evaluating care represent an inductivist model of reasoning in which all the data is gathered before a decision is made (Dowie 1988). This linear progression through the stages of the nursing process is a direct contradiction to the dynamic model of clinical reasoning described in the line of reasoning in chapter six. The findings of this study show that nurses apply a range of cognitive operators to highly structured and organised, domain specific, knowledge during clinical reasoning. Roberts et al (1995) suggest that a review of the nursing process as the main vehicle for operationalising problem solving in nursing practice is now required. They too identify the conflict of the essentially linear approach of the nursing process with the empirical evidence that problem solving is cyclical in nature characterised by information seeking, inference and further information seeking until action can be taken or a plan formulated. The nursing process is not underpinned by an understanding of how knowledge is organised in long term memory and utilised in clinical reasoning. It therefore does not facilitate or explain the development of knowledge schema as the means of organising knowledge content. In terms of the utilisation of knowledge, the linear process does not allow for the immediate interpretation of clinical data as soon as it is
elicited. As has been shown the rapid recognition of triggering cues leads to the activation of schema which direct subsequent information seeking activity until a judgement about the patient's nursing problems can be made. The nursing process may continue to have a value in providing a framework for recording nursing activity and presenting the application of content knowledge to a clinical problem for students. However, it is not a useful vehicle for either explaining or facilitating the clinical reasoning skills used by expert nurses. It is suggested that the focus of teaching should therefore change from emphasising the nursing process as a single linear process to developing a range of clinical reasoning skills and facilitating the development of knowledge schema, as discussed above.

7.4 THE RELATIONSHIP OF THE STUDY FINDINGS TO KEY CONCEPTS IN NURSING

The findings of this study provide empirical evidence to support some of the values and concepts which are considered to have relevance for nursing. The concept of holistic care is one such concept. In the purest sense holism is based on the assumption that a whole cannot be reduced to discrete elements. However, the term as it is used in relation to nursing practice refers to a value of the whole patient but through consideration of discrete parts that are interrelated (Chinn and Jacobs 1987). Thus the Canadian Nurses Association (1980) definition of nursing and standards of practice states that:

"Nurses value a holistic view and regard an individual as a biopsychosocial being."
This view is also encapsulated in Neuman's (1974) model of nursing in which the individual is viewed as a unique, holistic system encompassing physiological, sociocultural, and development variables. Other nursing theorists also embrace a holistic view of the individual (Henderson 1966, Levine 1967, Rogers 1970, Orem 1971, Roy 1976). The findings of the second study showed that nurses attend to a wide range of phenomena which were described as clinical and personal. They sought information on the patient's patho-physiological features but they also sought information on the patient's social situation (home environment and family, for instance) and his emotional response to his condition. Considerable emphasis was placed on getting to know the patient as a person.

This is linked to another important idea in nursing, that of the significance of the nurse-patient relationship. Two early nursing theorists emphasised the interpersonal nature of nursing (Peplau 1952 and Travelbee 1971). Peplau (1952) viewed nursing as an interpersonal process that requires human relatedness. Thus through the establishment of human to human relationships between nurses and patients, needs are met and the process of illness and suffering coped with. The findings of this study suggested that nurses considered establishing a relationship with the patient to be important. They sought to use this relationship to therapeutic effect by offering comfort and emotional support to patients. Establishing rapport with patients enhanced their ability to elicit information as part of the problem solving process. Getting to know the patient also afforded nurses the opportunity to know what type of person the patient was and understand them as an individual.
Another recurring theme in nursing theory is the uniqueness of the individual (Peplau 1952, Orlando 1961, Travelbee 1971, Henderson 1966, Neuman 1974). Getting to know the patient as an individual emphasis the uniqueness of their personal make-up and situation and therefore their unique response to their condition. Each patient is considered to respond to their illness in a different way and therefore present with an individual array of nursing problems. In response to their recognition of the uniqueness of the individual, nurses have developed the idea of individualised care. This is based on the principle that nurses will provide physical and psychological care tailored to specific requirements of individual patients. It is suggested that physical, mental and even domestic variations will necessitate a flexibility of approach which is dependent on the nurse knowing her patient (Wilson-Barnett 1988). The findings of this study suggest that nurses’ knowledge is organised as schema which include planning knowledge. Thus when a nursing problem is judged to be present knowledge of the relevant nursing intervention is also available. The close juxtaposition of the processes inference and plan was noted as evidence of this. However, nurses also appeared to modify interventions suggested by schema based planning knowledge in the light of their understanding of the patient as a person. It is therefore suggested that nurses use their knowledge in relation to personal phenomena to modify and adapt the schema based response to the patient’s clinical characteristics. This appears to be the basis for the provision of individualised care. This view is supported by Radwin (1998) who noted that with experience the nurse was more likely to focus on the patient so that the patient’s experiences, behaviour, emotions and perceptions became the most salient aspects of the information available. This knowledge was then used by subjects to decide about the care to be
delivered and it was therefore concluded that the nurse’s focus on the patient enhances the individualisation of care (Radwin 1988).

To summarise, the findings of this study have provided evidence of the holistic approach by identifying the range of phenomena that nurses attend to. Nurses were found to give high priority to gaining the patient’s trust and establishing a relationship with them as a means of providing emotional support and comfort. Finally empirical evidence was derived which provides a basis for understanding how nurses use their knowledge of the unique characteristics of the individual to deliver individualised care.

7.5 **RECOMMENDATIONS FOR FURTHER RESEARCH**

The methodological approach used in this study elicited a wealth of data which could be used for further analysis. For instance, it would be possible to identify lines of reasoning for each topic where the nurse made an inference. This would produce generalisable data on how nurses utilise knowledge, from both the presenting situation and long term memory, to transform knowledge states on their journey through the problem space across a range of nursing problems.

It would also be possible to use the data collected thus far to identify the contents (as far as they were verbalised) of nurses’ knowledge schema. This would increase understanding of how nurses organise their knowledge in long term memory.

Further research could also be directed at examining the concepts around which schema are structured, particularly whether these are predominantly medical
diagnostic concepts or whether they are concepts that relate to patho-physiological
states that can be ameliorated through nursing intervention e.g. pain, immobility,
constipation, anxiety.

The way in which nurses attend to information, what phenomena they attend to and
which cues they recognise as salient could usefully be examined as an indication of
the content and structure of their knowledge.

An investigation of metacognitive strategies used by expert nurses would increase
knowledge of how nurses structure and approach clinical reasoning tasks.

7.6 CONCLUSIONS

1. During the course of assessing patients nurses attend to both clinical and personal
phenomena. Clinical phenomena relate to the clinical characteristics of the patient
such as signs and symptoms, ability to carry out activities of daily living, and
treatment and services received. Personal phenomena encompass those
phenomena which address the patient’s personal circumstances, such as home
environment and family, and those phenomena which describe the patient as a
person.

2. Nurses’ knowledge is organised in long term memory as schema which provide
the basis for interpreting data and guiding the collection of further data. Nurses
schema contain identification, elaboration and planning knowledge. Schema
which relate to clinical phenomena can be described as event schema
(Augoustinos and Innes 1990) which enable the nurse to identify the patient’s
current nursing problems, predict future nursing problems and plan intervention. Schema which relate to personal phenomena can be described as person schema or person prototypes (Cantor and Mischel 1976a). They enable the nurse to identify what type of person the patient is, understand and anticipate their behaviour.

3. Personal phenomena provide the context for making plans in relation to clinical phenomena. An understanding of personal phenomena enables the nurse to modify the response suggested by planning knowledge stored within a schema. This provides the basis for the delivery of individualised care.

4. The assessment task is schema driven rather than menu driven. The topics covered by nurses represent sub goals which must be achieved in order to contribute to the overall goal of assessment: identifying the state of the patient in response to his medical condition and establishing what nursing intervention is required. The topics are suggested by the elaboration knowledge stored in schema which enables the nurse to anticipate the type of problems a patient may have.

5. The topics covered vary across cases. The basis for divergence is the individual characteristics of the patient, both clinical and personal. Topics which do tend to occur across cases relate to "setting the scene" and planning intervention.

6. The assessment task is structured into three phases: introductory, working and concluding. The introductory and concluding phase cover similar topics across cases, aimed at establishing a general picture of the patient and finalising the plan of care, respectively. The working phase shows the greatest divergence of topics
covered between cases. There is some evidence that the structure of the working phase varies when a physical intervention is required and this information is given in the referral. The approach to assessment also appears to vary depending on whether the case is considered to be short or long term.

7. Assessment is seen as a continuous process, with nurses focusing on the salient points and identifying topics which can be pursued subsequently. Nursing assessments are also considered to be dynamic, changing as the patient’s condition changes. Assessment is therefore continuous as the patient’s condition has the potential to vary continuously.

8. Four cognitive operators were utilised by nurses during the assessment task: search, inference, action and plan. It is suggested that there are different levels of inference ranging from an initial interpretation of the data to a conclusion about what nursing problems the patient has.

9. A line of reasoning can be drawn to show how nurses use the operator search to elicit data from the clinical environment, triggering cues present in the data then activate schema stored in long term memory. Thus data in the presenting situation is integrated with information in long term memory to give rise to inferences and predictions about the state of the patient. Because nurses’ schema also contain planning knowledge they are able to take action and plan care as soon as an inference has been made. Thus nurses apply cognitive operators to data in the presenting situation and information stored in schema to transform their
knowledge states as they move through the assessment task from initial state to goal state.

10. Nursing education should focus on developing the organisation of knowledge into schema. Nurses should also be facilitated in the development of metacognitive strategies which will enable them to structure and monitor their performance of cognitive tasks. Learning should be achieved through opportunities for practice with clinical problem solving followed by feedback.
APPENDIX ONE: *Coding Framework Developed by Gale (1980) for Depicting Thinking Processes*

<table>
<thead>
<tr>
<th>Process</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-diagnostic interpretation of clinical information</td>
<td>An active interpretation of the clinical information available where the result of this activity is not sufficiently specific to constitute a possible diagnosis</td>
<td>“Myocardial problem”&lt;br&gt;“A metabolic abnormality”&lt;br&gt;Anaemia caused by blood loss</td>
</tr>
<tr>
<td>Diagnostic interpretation of clinical information</td>
<td>An active interpretation of clinical information where a pathophysiological process is indicated with a degree of specificity which is sufficient for a diagnosis</td>
<td>“Carcinoma of the pancreas”&lt;br&gt;“Acromegaly”</td>
</tr>
<tr>
<td>Judgement of need for further general or clarifying enquiry not stemming from either pre-diagnostic or diagnostic interpretations</td>
<td>Where the clinician enquires further about the patient’s symptoms, signs etc. for clarification or seeks to clarify the patient’s statement</td>
<td>“I was asking how the pain affected him”&lt;br&gt;“I asked her how she didn’t feel well”</td>
</tr>
<tr>
<td>Expecting, searching for or planning to search for specific features (symptoms, signs, tests etc.) of disease or treatment of disease</td>
<td>Where the clinician shows expectation of certain clinical information or considers certain features of disease likely or possible in the patient, given the information already elicited</td>
<td>“If we investigated the patient I imagine we’d find X.”</td>
</tr>
<tr>
<td>Reinterpretation of clinical information, when no new information has been added</td>
<td>Where an array of clinical information which has already been interpreted in some way becomes amenable to a new interpretation because of a change in the clinician’s own thinking and not because new information has been added to the array</td>
<td>“it was creeping into my mind / struck me / flashed through my mind that he may have diagnosis x”&lt;br&gt;“I suddenly saw that symptoms x and y were related / separate.”</td>
</tr>
<tr>
<td>Reinterpretation of clinical information arising from the addition of new information</td>
<td>Where an array of clinical information becomes amenable to new interpretation because of the new information to the array.</td>
<td>“Symptom X now suggests that it may be diagnosis Y”&lt;br&gt;“I’d thought of diagnosis X, but when I asked further questions, I realised that diagnosis Y was the case.”</td>
</tr>
</tbody>
</table>
| Enquiry responsive to elicited information | Where the course of the interview as directed by the clinician is determined by, or follows on from, the flow of information as presented by the patient. | “If a system came up I dealt with it there instead of waiting for the systematic enquiry.”
“’I decided to go to the CVS there because it was relevant to what she just mentioned.” |
| Enquiry determined by the clinician’s interpretations | Where the course of the interview is determined by the clinician’s requirement actively to test his/her interpretations of the clinical information | “I was thinking in terms of diagnosis X, so I asked about symptom X.”
“I was looking for symptoms X, Y, Z.” |
| Routine enquiry | Where the clinician conducts, or attempts to conduct, the interview according to a routine format at defined by the standard clinical history. | Presenting complaint
History of the present complaint
Symptomatic survey
Past Medical History
Family History
Social History
Drug survey |
<p>| Failure to make a specific enquiry | Where the clinician identifies, in retrospect, his/her own failure to make relevant, specific enquiry concerning the patient’s problems, signs, symptoms etc. | “I should have gone into that symptom in more depth, but I forgot” |
| Failure to make general enquiry | Where the clinician identifies, in retrospect, his/her own failure to make sufficient routine, general or screening enquiry. | “I could have asked a lot more questions about this system, but I tend to forget them unless they seem necessary.” |
| Active confirmation of an interpretation | Where the clinician feels that the selected interpretation is confirmed as an actual diagnosis. | “My conclusion is that she’s suffering from diagnosis X.” |
| Active elimination of an interpretation | Where the clinician eliminates an identified interpretation because of contrary evidence or positive lack of necessary evidence | “I’d pretty well dismissed diagnosis X because he hadn’t got symptom Y.” |
| Postponement of judgement | Where an identified possible interpretation is neither confirmed nor eliminated by clinician but is left under postponed judgement | “She’s the right category for disease X, but I don’t know any questions that could diagnose that.” |</p>
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<tr>
<th>Number</th>
<th>Category</th>
<th>Definition</th>
<th>Example</th>
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<tbody>
<tr>
<td>1</td>
<td>Acquires cues</td>
<td>The District Nurse (DN) asks questions to obtain information on a new topic, prior to any evidence of hypothesis formation</td>
<td>Up until now how have you been? Do you take any tablets? What is your date of birth? Do you sleep well?</td>
</tr>
<tr>
<td>1a</td>
<td>Plans cue acquisition</td>
<td>DN expressed an intention to gain more information / not to collect any further information</td>
<td>I'll take a closer look at that. I'll ask you about that in a minute</td>
</tr>
<tr>
<td>2</td>
<td>Attends to cues</td>
<td>DN responds to questions and pt. volunteered information and shows recall of cues in the stimulated recall session. DN repeats word for word or paraphrases what the patient has said</td>
<td>That makes you 73 then Your son lives quite close then.</td>
</tr>
<tr>
<td>3</td>
<td>Interprets cues</td>
<td>DN uses them, phrase or statement which indicates she has made some interpretation of the information available</td>
<td>Your blood pressure's quite low. You're walking around quite well.</td>
</tr>
<tr>
<td>4</td>
<td>Makes further general/specific enquiry</td>
<td>DN seeks to expand or clarify information given or follows a specific line of enquiry</td>
<td>How long have you had this? What sort of pain.</td>
</tr>
<tr>
<td>5</td>
<td>Expecting, searching for, or planning to search for specific features</td>
<td>DN shows expectation of certain features, given the information already elicited</td>
<td>With your water tablets do you have any difficulty that you need to go all of a sudden and you can't hang on? Do you have a problem with a cough when you've been smoking?</td>
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<tr>
<td>6</td>
<td>Active confirmation of nursing diagnostic inference</td>
<td>DN gives patient or investigator a statement of the nursing problems she had identified or states that there are no nursing problems</td>
<td>So generally your main problems are that you don’t walk very well and you don’t get out and about a lot, and that you get these recurrent problems with your leg. I think at the moment she hasn’t got many nursing needs. I think maybe she’s got a few social ones.</td>
</tr>
<tr>
<td>7a</td>
<td>Possible actions reviewed</td>
<td>DN discusses and weighs up the actions that could be taken</td>
<td>They’ve been putting Granuflex on that and I’m not sure… She might be suitable for a domiciliary visit.</td>
</tr>
<tr>
<td>7</td>
<td>Nursing action inference made</td>
<td>DN makes a statement about a course of specific or individualised action/treatment which she judges either should or should not be taken</td>
<td>I thought a bit of Granuflex is quite good here. I’ll arrange for the occupational therapist to come. The care plan I’m going to leave for the moment and review when I’ve actually had a chance to think about it.</td>
</tr>
<tr>
<td>8</td>
<td>Forward Planning</td>
<td>The DN describes an action plan for the future.</td>
<td>As it gets better we’ll reduce it.</td>
</tr>
<tr>
<td>12</td>
<td>Failure to make an enquiry</td>
<td>DN identifies, in retrospect, her failure to make a relevant enquiry</td>
<td>Certainly I should have asked her about her teeth and I just didn’t.</td>
</tr>
<tr>
<td>13</td>
<td>DN gives the rationale for her practice/inference</td>
<td>DN explains the reason for her nursing action or the reason for a particular inference</td>
<td>I’m not actually going to touch that because it’s well sealed off. Every time you take it off you’re risking infection aren’t you.</td>
</tr>
<tr>
<td>14</td>
<td>DN comments on her own performance</td>
<td>DN discusses or evaluates her on performance during the stimulated recall session</td>
<td>We spent a long time discussing diet.</td>
</tr>
<tr>
<td>15</td>
<td>Pre-diagnostic interpretation of clinical information</td>
<td>DN makes an inference without giving a nursing diagnosis. These inferences can be about possible diagnoses, treatment and the patient's ability to carry out activities of daily living</td>
<td>I wonder if it was something like calciferol injection—I'm sure it is. It's more than just stress incontinence.</td>
</tr>
<tr>
<td>16</td>
<td>Organising the delivery of care</td>
<td>DN makes statements about who is going to give care, when care is to be given, what materials are necessary to deliver care</td>
<td>Not Tuesday or Thursday because you're going to the Day Centre, so it'll probably be Wednesday or Friday</td>
</tr>
<tr>
<td>17</td>
<td>DN refers to past experience/knowledge base to explain something other than her own practice</td>
<td>DN gives an explanation by recounting a past experience or making a generalised statement based on her knowledge of usual practice.</td>
<td>They tend to keep them in about a week for that</td>
</tr>
<tr>
<td>18</td>
<td>Social conversation</td>
<td>General chat between the nurse, patient, investigator and/or others in the house that is not related to establishing the nursing problems or planning nursing actions</td>
<td>What a lovely garden you have.</td>
</tr>
<tr>
<td>19</td>
<td>Cue proffering</td>
<td>Patient or carer volunteers a piece of information that is not given in response to a question from the DN</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Patient/carer question</td>
<td>The patient or carer asks the DN a question</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Planning/structuring the visit</td>
<td>DN makes a statement about how she is going to conduct the visit</td>
<td>I'll look at your let first and then I'd like to ask you some questions</td>
</tr>
<tr>
<td>22</td>
<td>Establishing that the assessment can proceed</td>
<td>DN gathers information necessary to proceed with the visit</td>
<td>Can you hear? Are you comfortable in that chair?</td>
</tr>
</tbody>
</table>
| 23 | Routine verbal and non-verbal responses | Standard responses to show understanding and/or encourage the patient/carer to continue | Mmmmm
Uh huh
Oh dear
Good
That’s right |
|---|---|---|---|
| 24 | Giving an explanation to advice to patients | DN explains a diagnosis, treatment or procedure to the patient, advises them on what to do or gives them some information | You must wear these stockings to keep the swelling down.
You can ring me at the health centre and leave a message. |
| 25 | Validating an inference/checking information | DN questions the patient or simply makes an inference to see how the patient responds. The DN checks information she already has with the patient. | That look sore
Are you a bit tired?
You're 73
Your GP is Dr.--- |
| 26 | Patient confirms inference | The patient/carer indicates that the DN’s inference is valid. | Oh yes
That’s right
Mmmmm |
| 27 | Patient replies to question | The patient replies to the question the DN asked with the exact piece of information she requested and nothing more | I’m 76
I was in three weeks |
| 27a | Reply plus additional information | The patient replies and gives some additional information which may or may not be relevant to the enquiry | I was in ten days and never slept a wink
I’m 70 but I felt ninety this morning |
| 28 | Anticipation or understanding of the cause of the problem | The DN identifies the potential cause of the problem and validates this with the patient or states this during the recall session | Maybe there’s some toxicity from her foot, you know it’s just thrown her and she’s generally unwell
She’s been falling more than usual in the last few weeks so it may just be that her feet are hurting or whatever and she’s not balancing. |
<p>| 28a Questions treatment to date | The DN questions/debates the reason for a particular treatment the pt has had | I was sort of thinking why did he go and have his chole? Was he obstructing? Was he jaundiced? Did he have pain? |
| 29 Instructs the pt | The DN gives straightforward instructions to patients during the course of treating them | Roll over Lift your leg a bit |
| 32 An explanation of thinking, known to be incorrect | The DN gives a reason for making a particular inference or seeking a particular cue which is shown by the evidence to be incorrect | DN cites a particular cue as reason for making an inference when this cue has not yet occurred in the visit. She is therefore rationalising retrospectively why she had made an inference not reporting her thinking at the time the inference was made. |
| 33 Identifies the confirming or refuting cue or cue cluster | The DN identifies what it was that led her to make/confirm an inference | When she said that, I thought “oh I must have been right” |
| 35 Identifies the cue which ruled out an inference | The DN receives subsequent data which rule out an earlier inference | I was thinking perhaps if he was obstructed he may have a larger tumour somewhere, but he went on to say that he, as far as he was concerned, it was clear |
| 34 Expresses confusion/surprise over data acquired | The DN receives information which does not meet with her expectations | I certainly didn’t expect something that size – I expected an ulcer |
| 37 Story telling | The patient, nurse or carer tells a story about something that has happened to them usually to illustrate a point | |
| 38 Seeking information to plan nursing action or the organisation of care | The DN gathers information to help her decide on a course of action or organise the delivery of nursing care | You don’t know what size it is do you? Is it a G? Do you want me to come in, towards the end of the week say, and change it prior to the hospital? |</p>
<table>
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</thead>
<tbody>
<tr>
<td>39</td>
<td>Hypothesis directed data search</td>
<td>The DN acquires cues in relation to a particular inference. The visit data and recall data need to be considered together in order to establish that cue acquisition was related to a particular hypothesis</td>
<td>I wondered if he had some sutures that had got infected and ten days post-op he'd had a secondary infection. [Explanation for questions asked during visit]</td>
</tr>
<tr>
<td>40</td>
<td>Information gathering about patient's treatment</td>
<td>The DN seeks information to ascertain what treatment the patient has had or is receiving.</td>
<td>Do you know what they have been dressing it with at all?</td>
</tr>
<tr>
<td>41</td>
<td>Failure to attend to a cue</td>
<td>The DN identifies, in retrospect, her failure to attend to a cue</td>
<td>I hadn't noticed the smell when we went in</td>
</tr>
<tr>
<td>42</td>
<td>Problem identification by the patient</td>
<td>The patient or carer identify what they consider the problem to be</td>
<td>My main problem is my breathing</td>
</tr>
</tbody>
</table>
APPENDIX THREE: Coding Schedule for Topic Categories

<table>
<thead>
<tr>
<th>Topic number</th>
<th>Topic</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Background to the presenting problem</td>
<td>Discussion aimed at establishing what has happened in the run up the current situation</td>
</tr>
<tr>
<td>2</td>
<td>Activity level</td>
<td>General discussion aimed at establishing in broad terms the patient’s activity levels e.g. “as you’ve broken your arm there must be lots of things you can’t do”</td>
</tr>
<tr>
<td>3</td>
<td>Patient’s current status</td>
<td>Discussion aimed at establishing the patient’s general condition (as opposed to activity levels) e.g. “what I was wanting to ask you about was just how you are getting on”</td>
</tr>
<tr>
<td>4</td>
<td>Emotional and mental health status</td>
<td>Discussion relating to the patient’s emotional and psychological well being e.g. worries, depression, anxiety</td>
</tr>
<tr>
<td>5</td>
<td>Skin condition</td>
<td>Discussion relating to the condition of the patient’s skin</td>
</tr>
<tr>
<td>6</td>
<td>Temperature</td>
<td>Patient’s ability to maintain body temperature and temperature of the peripheries.</td>
</tr>
<tr>
<td>7</td>
<td>Fatigue levels</td>
<td>Discussion relating to patient tiredness</td>
</tr>
<tr>
<td>8</td>
<td>Condition of the patient’s legs</td>
<td>Discussion relating to the condition of the patient’s legs e.g. condition of skin, presence of oedema etc</td>
</tr>
<tr>
<td>9</td>
<td>Baseline observations</td>
<td>Discussion relating to measuring baseline observations and the results.</td>
</tr>
<tr>
<td>10</td>
<td>Pressure areas</td>
<td>Discussion related to the status of the patient’s pressure areas, degree of risk for developing pressure sores etc.</td>
</tr>
<tr>
<td>11</td>
<td>Self Image</td>
<td>Discussion in relation to the patient’s expressed view of themselves or patient’s comment on their body image.</td>
</tr>
<tr>
<td>No.</td>
<td>Category</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------</td>
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</tr>
<tr>
<td>12</td>
<td>Patient’s progress</td>
<td>Discussion involving a comparison of the patient’s current status to some point in the past or some anticipated state in the future</td>
</tr>
<tr>
<td>13</td>
<td>Summary of the patient’s problems</td>
<td>Listing of the problems identified thus far in the assessment</td>
</tr>
<tr>
<td>14</td>
<td>Patient’s adaptation to his condition</td>
<td>Discussion relating to the patient’s psychological/emotional response to their condition</td>
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<tr>
<td>15</td>
<td>Bathing/washing</td>
<td>Discussion related to the patient bathing or washing</td>
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<tr>
<td>16</td>
<td>Hobbies/social activity</td>
<td>Discussion relating to patient’s recreational activities such as hobbies and going out.</td>
</tr>
<tr>
<td>17</td>
<td>Mobility</td>
<td>Discussion relating to any aspect of patient mobility e.g. in and out of bed, balance, etc</td>
</tr>
<tr>
<td>18</td>
<td>Bowels</td>
<td>Discussion of bowel function</td>
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<tr>
<td>19</td>
<td>Urinary elimination</td>
<td>Discussion relating to the patient’s urinary system</td>
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<tr>
<td>20</td>
<td>Toiletting</td>
<td>Discussion relating to the patient’s ability to access and use the toilet.</td>
</tr>
<tr>
<td>21</td>
<td>Driving/Parking</td>
<td>Discussion related to driving and access issues such as parking</td>
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<tr>
<td>22</td>
<td>Employment</td>
<td>Discussion relating to the patient’s current employment status and previous employment.</td>
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<td>23</td>
<td>Getting dressed</td>
<td>Discussion relating to the patient’s ability to get dressed</td>
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<td>24</td>
<td>Appetite</td>
<td>Discussion relating to the patient’s appetite</td>
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<tr>
<td>25</td>
<td>Eating</td>
<td>Patient’s ability to eat and dietary issues</td>
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<tr>
<td>26</td>
<td>Fluid intake</td>
<td>Discussion related to the patient’s consumption of liquids</td>
</tr>
<tr>
<td>27</td>
<td>Safety</td>
<td>Discussion relating to any aspect of patient safety e.g. emergency alarm, getting a phone</td>
</tr>
<tr>
<td>28</td>
<td>Shopping</td>
<td>Discussion relating to patient’s ability to do/organise shopping to be done</td>
</tr>
<tr>
<td>29</td>
<td>Housework</td>
<td>Discussion relating to the patient’s ability to do/organise to be done</td>
</tr>
<tr>
<td>30</td>
<td>Smoking</td>
<td>Any aspect of discussion in relation to smoking e.g. whether the patient is a smoker, how many, how long for, expressed desire to give up etc.</td>
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<tr>
<td>31</td>
<td>Alcohol intake</td>
<td>Discussion in relation to patient’s drinking habits.</td>
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<tr>
<td>32</td>
<td>Vision</td>
<td>Discussion aimed at establishing the patient’s ability to see clearly, whether the patient wears glasses etc.</td>
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<tr>
<td>33</td>
<td>Hearing</td>
<td>Discussion relating to the patient’s ability to hear, use of hearing aid etc.</td>
</tr>
<tr>
<td>34</td>
<td>Dentition</td>
<td>Discussion aimed at establishing whether there are any problems with the patient’s teeth, whether they wear dentures etc.</td>
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<tr>
<td>35</td>
<td>Breathing</td>
<td>Discussion relating to the patient’s ability to breathe without difficulty</td>
</tr>
<tr>
<td>36</td>
<td>Cooking</td>
<td>Discussion related to patient’s ability to cook or make other arrangements</td>
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<tr>
<td>37</td>
<td>Sleeping</td>
<td>Discussion relating to patient’s sleep pattern</td>
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<td>38</td>
<td>Wife’s health</td>
<td>Discussion relating to the health of the patient’s wife</td>
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<td>39</td>
<td>Wife’s family history</td>
<td>Discussion relating to wife’s family background</td>
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<td>40</td>
<td>Husband’s requirements for care</td>
<td>Discussion relating to the degree of care required by the patient’s husband</td>
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<tr>
<td>41</td>
<td>Husband's incontinence</td>
<td>Discussion of the patient’s husband’s problem of incontinence</td>
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<tr>
<td>42</td>
<td>Discussion of treatment/services to date</td>
<td>Discussion relating to the management of the patient hitherto and the services they have received</td>
</tr>
<tr>
<td>43</td>
<td>Discussion of current treatment</td>
<td>Discussion of the treatment the patient is receiving currently.</td>
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<tr>
<td>44</td>
<td>Emergency respite care</td>
<td>Availability of and arrangements for accessing respite care in an emergency.</td>
</tr>
<tr>
<td>45</td>
<td>Co-ordination of care</td>
<td>Discussion over which professional is the main point of contact for the patient and has overall responsibility for co-ordinating all other agencies and professionals.</td>
</tr>
<tr>
<td>45</td>
<td>Accessing the DN service</td>
<td>Discussion involving information on how and when to access the DN service, the DN role etc.</td>
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<tr>
<td>47</td>
<td>Discussion of services available</td>
<td>Information given in relation to relevant services that are available and how to access them.</td>
</tr>
<tr>
<td>48</td>
<td>Wound dressing</td>
<td>Discussion relating to the type of dressing used/to be used, changing dressing, care of dressing etc.</td>
</tr>
<tr>
<td>49</td>
<td>Wheelchair</td>
<td>Any discussion related to wheelchairs – need for, maintenance etc.</td>
</tr>
<tr>
<td>50</td>
<td>Medication</td>
<td>Discussion of any aspect of medication e.g. what medication is being taken, patient’s understanding, compliance, side effects.</td>
</tr>
<tr>
<td>51</td>
<td>Pain</td>
<td>Discussion related to establishing whether pain exists, its characteristics and strategies for its relief.</td>
</tr>
<tr>
<td>52</td>
<td>Swollen hand</td>
<td>Discussion in relation to a swollen hand</td>
</tr>
<tr>
<td>53</td>
<td>Dropped toe</td>
<td>Discussion relating to a dropped toe</td>
</tr>
<tr>
<td>54</td>
<td>Cramps</td>
<td>Discussion relating to muscle cramps</td>
</tr>
<tr>
<td>55</td>
<td>Allergies</td>
<td>Discussion related to known allergies</td>
</tr>
<tr>
<td>56</td>
<td>Wound</td>
<td>Discussion relating to the status of a wound</td>
</tr>
<tr>
<td>57</td>
<td>Swollen ankle</td>
<td>Discussion relating to a swollen ankle</td>
</tr>
<tr>
<td>58</td>
<td>Indigestion</td>
<td>Discussion relating to indigestion</td>
</tr>
<tr>
<td>59</td>
<td>Cystitis</td>
<td>Discussion relating to the complaint of cystitis</td>
</tr>
<tr>
<td>60</td>
<td>Pressure sore</td>
<td>Discussion related to pressure sores</td>
</tr>
<tr>
<td>61</td>
<td>Bruising</td>
<td>Discussion relating to the patient’s bruising</td>
</tr>
<tr>
<td>62</td>
<td>Patient’s understanding of his condition</td>
<td>Any discussion relating to the patient’s understanding of his diagnosis and the consequences thereof</td>
</tr>
<tr>
<td>63</td>
<td>Patient’s view of help required</td>
<td>Where the patient’s view is sought or offered in relation to the help they need</td>
</tr>
<tr>
<td>64</td>
<td>Patient’s understanding of treatment</td>
<td>Patient’s understanding of their treatment, the rationale, compliance etc</td>
</tr>
<tr>
<td>65</td>
<td>Patient’s personal details</td>
<td>Establishing personal details such as date of birth, phone number etc.</td>
</tr>
<tr>
<td>66</td>
<td>Past medical history</td>
<td>Discussion of the patient’s general past medical history not necessary related to the current problem.</td>
</tr>
<tr>
<td>67</td>
<td>Financial status/Benefit entitlement</td>
<td>Discussion of the patient’s financial circumstances, eligibility for benefits and how to apply.</td>
</tr>
<tr>
<td>68</td>
<td>Housing</td>
<td>Discussion related to patient’s living accommodation.</td>
</tr>
<tr>
<td>69</td>
<td>Level of support from family and other sources</td>
<td>Discussion aimed at establishing the patient’s family structure and their involvement in the patient’s care, and the involvement of other services.</td>
</tr>
<tr>
<td>70</td>
<td>Discussion of plan</td>
<td>Any discussion relating to the care plan e.g. what is to be done, when, by whom etc</td>
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## APPENDIX FOUR: Topic sequence of each visit

<table>
<thead>
<tr>
<th>Case One</th>
<th>Case Two</th>
<th>Case Three</th>
<th>Case Four</th>
<th>Case Five</th>
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<tr>
<td>Background to the presenting problem</td>
<td>Patient's current status</td>
<td>Employment history</td>
<td>Patient's current status</td>
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<td>Patient's understanding of his condition</td>
<td>Patient's progress</td>
<td>Patient's current status</td>
<td>Mobility</td>
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<td>Background to the presenting problem</td>
<td>Housing</td>
<td>Activity levels</td>
</tr>
<tr>
<td>Mobility</td>
<td>Patient's personal details</td>
<td>Level of support from family and other sources</td>
<td>Employment History</td>
<td>Patient's understanding of treatment</td>
</tr>
<tr>
<td>Hobbies/social activity</td>
<td>Level of support</td>
<td>Patient's adaptation to his condition</td>
<td>Housing</td>
<td>Swollen hand</td>
</tr>
<tr>
<td>Dropped toe</td>
<td>Shopping</td>
<td>Eating</td>
<td>Level of support from family and other services</td>
<td>Sleeping</td>
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<td>Temperature</td>
<td>Driving</td>
<td>Self image</td>
<td>Wheelchair</td>
<td>Pain</td>
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<tr>
<td>Bathing/washing</td>
<td>Background to the presenting problem</td>
<td>Sleeping</td>
<td>Emotional and mental health</td>
<td>Indigestion</td>
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<tr>
<td>Cramps</td>
<td>Condition of patient's legs</td>
<td>Elimination</td>
<td>Activity level</td>
<td>Bowel function</td>
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<tr>
<td>Emotional/mental health</td>
<td>Background to the presenting problem</td>
<td>Patient's understanding of his condition</td>
<td>Washing and getting dressed</td>
<td>Urinary elimination</td>
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<tr>
<td>Fatigue levels</td>
<td>Discussion of treatment to date</td>
<td>Employment history</td>
<td>Financial status/benefits</td>
<td>Fluid intake</td>
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<td>Patient's view of help required</td>
<td>Discussion of plan</td>
<td>Benefit entitlement</td>
<td>Employment history</td>
<td>Cystitis</td>
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<td>Discussion of plan</td>
<td>Discussion of plan</td>
<td>Background to the presenting problem</td>
<td>Fluid intake</td>
</tr>
<tr>
<td>Level of support from family and other sources</td>
<td>Discussion of plan</td>
<td>Discussion of plan</td>
<td>Alcohol intake</td>
<td>Skin condition</td>
</tr>
<tr>
<td>Accessing the DN service</td>
<td>Housework</td>
<td>Hobbies/Social activity</td>
<td>Smoking</td>
<td>Dentition</td>
</tr>
<tr>
<td>Past Medical History</td>
<td>Baseline observations</td>
<td>Discussion of treatment</td>
<td>Patient's personal details</td>
<td>Pressure sore</td>
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<tr>
<td>Appetite</td>
<td>Breathing</td>
<td>Discussion of services available</td>
<td>Skin problem</td>
<td>Discussion of plan</td>
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<td>Bowels</td>
<td>Past medical history</td>
<td>Emergency respite care</td>
<td>Sleeping</td>
<td>Driving ability</td>
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<td>Discussion</td>
<td>Past medical history</td>
<td>Discussion of services to date</td>
<td>Sleeping</td>
<td>Shopping and cooking</td>
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<td>Smoking</td>
<td>Discussion of plan</td>
<td>Medication</td>
<td>Dressing</td>
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<td>Toiletting</td>
<td>Alcohol intake</td>
<td>Discussion of plan</td>
<td>Activity level</td>
<td>Washing</td>
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<td>Activity level</td>
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<td>Access to toilet</td>
<td>Bruising</td>
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<td>Discussion of plan</td>
<td>Discussion of treatment</td>
<td>Bathing</td>
<td>Swollen hand</td>
<td>Body temperature</td>
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<td>Wife's health</td>
<td>Past medical history</td>
<td>Wound Dressing</td>
<td>Swollen ankles</td>
<td>Housework</td>
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<td>Appetite</td>
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<td>Sleep</td>
<td>Wound</td>
<td>Bowels</td>
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<td>Pressure areas</td>
<td>Hobbies/Social activity</td>
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<td>Husband's requirements for</td>
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<td>Eating and drinking</td>
<td>Personal details</td>
<td>Employment history</td>
<td>Husband's continence</td>
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<td>Patient's understanding of treatment</td>
<td>Hobbies/Social activity</td>
<td>Bathing</td>
<td>Summary of problems</td>
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<td>Pain</td>
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<td>Safety</td>
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<td>Accessing the DN service</td>
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<td>Discussion of plan</td>
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<td>Vision</td>
<td>Wife's family history</td>
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<td>Discussion of plan</td>
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<tr>
<td>Dentition</td>
<td>Discussion of plan</td>
<td>Patient's progress</td>
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<tr>
<td>Bathing</td>
<td>Patient's adaptation to his condition</td>
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<tr>
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<td>Patient's queries</td>
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