2013

Clinical Reasoning and Causal Attribution in Medical Diagnosis

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http://hdl.handle.net/10026.1/1535

http://dx.doi.org/10.24382/3953
University of Plymouth

CLINICAL REASONING AND CAUSAL ATTRIBUTION IN MEDICAL DIAGNOSIS

by

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A thesis submitted to the University of Plymouth in partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

School of Social Science and Social Work

Faculty of Health, Education and Society

November 2012

Linda Adams.

Clinical Reasoning and Causal Attribution in Medical Diagnosis.

Abstract

Forming a medical diagnosis is a complicated reasoning process undertaken by physicians. Although there has been much research focusing on clinical reasoning approaches, there is limited empirical evidence in relation to causal attribution in medical diagnosis. The research on which this thesis is based explored and examined the social process of medical diagnosis and provides an explanation of the clinical reasoning and causal attribution used by physicians. The research was undertaken in an Emergency Department within an acute hospital, the data were collected using mixed method approach including one to one semi-structured interviews with individual physicians; observation of their medical assessments of patients and secondary data analysis of the subsequent recorded medical notes. The study involved 202 patients and 26 physicians.

The analysis of the physicians' semi-structured interviews, shows how physicians describe the diagnostic step process and how they blend their clinical reasoning skills and professional judgment with evidence-based medicine. Physicians apply prior learning of taught biomedical and pathophysiological knowledge to question patients using pattern recognition of common signs and symptoms of disease. These findings are portrayed through taped narratives of the physician/patient interaction during the medical diagnostic process, which shows how physicians control the medical encounter.

The analysis/interpretation of documentary evidence (recorded medical notes) provides an insight into the way in which physicians used the information gathered during the diagnostic step process. By using SPSS it was possible to cluster the cases (individual patients) into groups. This stage-ordered classification procedure demonstrated commonality amongst individual cases whilst highlighting the uniqueness of any cases. A pattern emerged of two groups of cases: Group 1 - comprised of patients with the presenting complaints of chest pain, shortness of breath, collapse, abdominal pain, per rectal bleed, nausea, vascular and neurological problems and Group 2 - comprised of patients presenting with trauma, mechanical falls, miscarriage/gynaecological problems, allergies/rashes and dental problems. Findings show that the clinical reasoning approaches used varied according to the complexity of the patient's presenting complaint. The recorded medical notes for the patients in Group 1, were comprehensive and demonstrated a combined approach of hypothetic-deductive and probabilistic reasoning which enabled the physicians to deal with the degree of uncertainty that is inherent in medicine. The recorded process in the medical notes was shortened for the majority of patients in Group 2, and here the clinical reasoning approach used was found to deterministic. It is acknowledged, that this is not always the case. By using crisp set QCA it was possible to explore causal conditions consistent with Group 1. Further analysis led to examination of the link of causal conditions presented in the medical notes with the individual impression/working diagnosis made by physicians.

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Acknowledgements

I would like to offer my sincere gratitude to my supervisors, Professor Gayle Letherby, Professor Malcolm Williams and Associate Professor Oonagh Corrigan for their unfailing support, guidance and patience. The completion of this thesis would not have been possible without them.

I would also like thank the physicians in the ED, for allowing me to interview them and observe their clinical practice. The patients who agreed to take part in my research study, and the ED staff who accepted me into their clinical area, especially the Lead Consultant.

Lastly, I would like to thank all my family, for their support and tolerance.

AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy have I been registered for any other University award.

This study was financed with the aid of a studentship from Plymouth University.

Relevant seminars and conferences were attended at which my work was presented:

Poster presentation: Methods of Plymouth Conference, 2010.

Presentations:

Post Graduate Symposium, November 2010.

Made in Plymouth Conference, April 2011.

Institute of Clinical Education (ICE) Seminar, Exeter. May 2012.

Institute of Clinical Education (ICE) Seminar, Plymouth. June 2012.

Word count of main body of thesis: 76,901.

Signed .....

Date.....

Chapter 1 - Introduction

1.1 Introducing the area and the research

The research on which this thesis is based explored clinical reasoning and causal attribution in medical diagnosis. Medical diagnosis is a complicated process, and involves a physician[1] trying to identify the probable cause of a patient's presenting complaint [2]. Since the 1980s, much discussion and research has been undertaken to explore the nature of clinical reasoning in medical diagnosis (e.g. Norman 2005, Radwin 1990, Bursztajn et al 1990, Elstein et al 1978,). However, this previous research was concerned with the problem solving approaches used by physicians in medical diagnosis, rather than the causal conditions that may have informed their clinical decisions. In fact, there has been limited empirical evidence published on causal attribution in medical diagnosis.

It is suggested that:

> ... to solve a clinical diagnostic problem means first to recognise a malfunction and then to set about tracing or identifying its causes. The diagnosis is thus an explanation of disordered function, where possible a causal explanation (Elstein and Schwartz 2002: 729).

Scott (2009) viewed making the right medical diagnosis as the first step to optimal patient care. However, due to the uncertainty that is inherent in

[1] I use the term physician throughout my research study rather than doctor, as I feel it encompasses the various grades of medical personnel that took part. See Glossary for information.

[2] Patient's presenting complaint is the term used for the condition or incident that the patient has complained about prior to admission. For example; the patient has complained of having a pain in their chest or having had a fall. If the patient was found at home, unconscious, then the presenting complaint would be collapse - query cause.

medicine, medical diagnosis in the clinical setting is not straightforward. As Ghosh (2004: 48) states:

> ... uncertainty in diagnosis is frequently encountered in medical practice and causes stress in patients and physicians. Factors contributing to uncertainty include biological variability of patients, patient and physician bias, error in test interpretation, differing values and opinions of patients and physicians, and uncertainty surrounding decision-making.

The greatest deficiency of medical education throughout the 20th Century was seen to be the failure to train medical students properly for clinical uncertainty (Fox 1987). This is recognised in *Tomorrow's Doctors* (2009) which states that

> ... the doctor as a practitioner needs to be able to make an initial assessment of the patient's problems and a differential diagnosis; to understand the processes by which doctors make and test a differential diagnosis; to make clinical judgments and decisions based on the available evidence (GMC 2009: 20).

This seems a reasonable requirement, but how does it work in clinical practice? Whilst it has been accepted that clinical reasoning and clinical knowledge is interdependent (Higgs and Jones 2000), empirical evidence on *how* clinical, biomedical, empirical and tacit knowledge plays a part in the physician' clinical reasoning is limited. The research reported here helps to inform existing research by showing how knowledge is used by physicians during their clinical reasoning and causal attribution in the medical diagnostic process.

This study aims to provide a novel and useful insight into physicians clinical reasoning and causal attribution in medical diagnosis. Given the high prevalence of errors in medical diagnosis (Newman-Toker and Pronovost 2009, Croskerry 2003 and Riegelman 1991) any improvement in the understanding of

the medical diagnostic process, such as this study provides, is worthwhile and necessary.

1.2 Introducing my approach

The research study on which this thesis is based has allowed me to explore the medical diagnostic process in its entirety with reference to the role of the physician, who is the person responsible for forming a medical diagnosis. I chose to focus on an emergency department in an acute hospital as this provided me with a busy clinical environment where clinical decisions have to be made within tight time-scales. I purposely wanted a clinical area that provided me with grades of physicians with diverse levels of experience and a substantial number of patients with a range of presenting complaints. The aim of the study was to show how the micro and meso social processes and individual clinical reasoning used by the physicians, led to their causal attribution of the probable cause of the patients' presenting complaints; the medical diagnosis.

The research objectives were:

- To explore the clinical assessment process undertaken by physicians when looking for a cause/s of a patient's presenting disease/illness.
- To explore the challenges physicians face in blending clinical reasoning with evidence-based medicine when diagnosing individual patients.
- To consider any social environmental factors which may influence the individual physician's reasoning skills (e.g. time constraints, availability of on-line information and peer pressure).
- To provide an explanation of the physicians' clinical reasoning process and causal attribution leading to them forming a medical diagnosis.

Undertaking my fieldwork in a clinical setting provided me with an ideal research opportunity, as I was gathering naturally occurring data from the medical diagnostic processes undertaken by physicians. By adopting a mixed method approach, I was able to gage the views of physicians and to observe them gathering information through the patient/physician interaction, clinical observations, examinations and investigations. Thus, I was also able to investigate the physicians' clinical reasoning and how they blended their clinical reasoning with evidence-based medicine in clinical practice. Having access to the subsequent medical notes following each medical encounter, allowed me to note the information gathered by the physicians. This provided recorded clinical evidence of the process that had taken place and indicated the causal conditions that may have influenced the physicians' clinical reasoning as to the probable cause of a patient's presenting complaint.

By subsequently analysing/interpreting the data using SPSS, Nivo 8 and QCA, I was able to provide findings which enabled me to show the interdependency between the medical diagnostic step process and the types of clinical reasoning approaches used by physicians. I was able to identify causal conditions relating to the diversity of patients' presenting complaints and the subsequent impression/working diagnosis formed by the physician.

The diversity of experience of my physician respondents, enabled me to compare the practices of the expert and novice physician. I was aware that within the existing literature there had been studies undertaken distinguishing the difference between the expert and the novice physician (Patel, Arocha and Kaufman 1994; Boshuizen et al 1992). Whilst these studies were useful in appreciating the acquired skills of the expert, I found limited empirical evidence

within a medical setting to highlight the similarity between the two. My study provides empirical evidence which shows how similar the process of medical diagnosis is for the expert and the novice and how quickly the use of experiential learning clinical reasoning skills and empirical knowledge are acquired.

The findings provided some interesting statistics which were enriched by the use of taped narratives of the patient and physician interaction and the narratives between senior and junior physicians. The research findings have implications for future clinical practice and research.

1.3 Introducing myself as researcher

The way in which I conducted the research was influenced by my previous clinical and managerial background as well as my academic training. For many years, I practiced as a qualified registered nurse in acute medicine and then as a senior manager within the NHS, in various areas. Although I had a wealth of clinical experience, I knew very little academically about how physicians formed their medical diagnosis. However, I did understand the clinical practice and this helped me to design my research proposal to enable me to gain the information I felt would be required to answer my research question ‘how do physicians diagnose illness and disease in a medical setting?’

I am aware that I could be viewed as an ‘insider’ owing to my previous clinical experience and an outsider ‘as an academic researcher’. I explore these issues further in Chapter 3.

1.4 Introducing the thesis

In Chapter 2 I focus on the background literature in which to locate the study's theoretical context. This captures the scepticism that fuels the ongoing debate as to whether medicine is an art, a science or both and the sociological discourse surrounding the biomedical and social models. I note the changes that have occurred in medical education and the influence technology has had on the patient/physician interaction. The literature examined reveals the various views expressed and evidence presented by previous writers, with reference to, for example; medical diagnosis (Shiff and Leape 2012; Scott 2009); causal explanation (Simon,1968); causality (Riegelman1979; Hume,1876) complexity (Bryne, 2002; Hassey, 2002) and clinical reasoning (Higgs and Jones 2005; Kassirer 1989 and Barrows and Feltovich 1987). Particular note is given to the use of information, memory, knowledge, experience and professional judgement.

In Chapter 3 I describe my methodological approach and the methods used in the research study. This chapter provides a background for the choice of a case-based quasi-longitudinal study using mixed research methods. I provide an account of my experience when using these methods and how I explored and interpreted/analysed the collected data using SPSS, Nivo 8 and QCA.

In the first of three data chapters, Chapter 4 sets out the medical diagnostic step process undertaken by physicians in the emergency department. The chapter shows the step process related to the physicians gathering information when trying to identify the cause of the patient's presenting complaint. The findings shown relate to analysed/interpreted data of the physicians' interviews and the patients' medical notes.

Chapter 5 builds on Chapter 4. It shows the interdependency between the medical diagnostic step process and the clinical reasoning approach taken by physicians, when forming an impression/working diagnosis of the cause of a patient's presenting complaint. Here I use case-based examples of individual patients; through physician/patient interaction narratives and subsequent medical notes. This approach reflects the individuality of each patient and provides an opportunity to compare cases.

In the last of my three data chapters, Chapter 6 I reflect further on findings previously outlined in Chapter 4 and 5 linking these to the theoretical context outlined in Chapter 2 and to previous research. The chapter centres around the physicians' use of biomedical, pathophysiological, empirical and tacit knowledge during the medical diagnostic process.

In Chapter 7, the last chapter of the thesis, I make some final reflections regarding the research study. I evaluate what went well and what could have been improved. I also reflect on why and how the findings of my research may have implications for future clinical practice and/or for future research.

Chapter 2: Clinical Reasoning and Causal Attribution - Background and Context

'Medicine is a science of uncertainty and an art of probability.
- William Osler (1849–1919)

2.1 Introduction

In this chapter, I focus on the background literature in which to locate the study's theoretical context. A dictionary definition of medical diagnosis is given as 'the determination of the cause of a patient's illness or suffering by the combined use of physical examination, patient interview, laboratory tests, review of the patient's medical records, knowledge of the cause of observed signs and symptoms, and differential elimination of similar possible causes (Mosby 2009 cited by *thefreedictionary.com*). At face value, this appears to be a reasonably straightforward process. However, given the many factors that influence patients' health, inherent factors such as age; ethnic origin, sex and genetic make-up and external factors such as; social class, occupation, education, nutrition, habits, habitat and environment it is understandable that the cause of a patient's presenting illness/disease can be difficult to diagnose.

To appreciate the intricacies faced by physicians when endeavouring to form a medical diagnosis, I look back at the history of medicine and how medical advances based on science feed into the ongoing debate on whether medicine is an art, a science or both. I also set out an understanding of developments in modern medical training and education and the role that these developments play in preparing medical students to become the physicians of the future. It is

now claimed that patients should be at the centre of NHS care, therefore I look at how/if the relationship between the physician and the patient has changed and to what extent this may affect the medical encounter. Furthermore, I examine and explore existing literature to understand views already expressed regarding medical diagnosis, causality, complexity, clinical reasoning, clinical decision making, professional judgement and evidence-based medicine in relation to how a physician uses his/her clinical reasoning to explore the cause of a patient's presenting complaint prior to making a clinical decision. The intention here is to lay a foundation of background information and context on which to discuss the findings of my research study.

2.2 Is medicine an art, a science or both?

Many scientific advancements have informed the scientific view of medicine, this has led to a debate which is ongoing within medicine as to whether medicine is an art, a science or both. Since the early 16th Century scientists have applied new knowledge about the structure of the body and its function, for example; Vesalis (1538) dissected human corpses himself to reveal detailed information about human anatomy and Harvey (1628) scientifically studied the circulation of blood in the body. The medical conceptualisation of the body took place as technology developed. The stethoscope, developed by Rene Laennec, using a piece of wood to listen to the internal workings of a patient in 1816 (Starr 1982), enabled doctors to 'see' inside the patient and make their own observations of the body without having to rely on the patient's observations or outward signs. Signs pointed to the disease that gave rise to symptoms. Foucault (1976) describes these changes as part of a 'spatialisation' of illness. The body became three dimensional in that the 'depth' of the body represented

by its' inner space could be examined for signs. 'Inspection, palpation, percussion and auscultation make up the classic techniques of clinical examination used in the search for signs' (Armstrong 1995: 393). It was the discovery of X-rays (1895) which made the inside of the body visible and won Roentgen the Nobel prize in 1901.

During the 1800s, the rise of germ theory and cellular pathology took place. Germ theory stated that many diseases were caused by the presence and actions of specific micro-organisms in the body. Prior to the rise in germ theory, it was thought that disease was caused by a poisonous vapour in the air which contained decaying matter which was characterised by its foul smell. This theory competed with germ theory for many years. To remove the foul smell sanitary reforms were undertaken and bad housing, sanitation and general cleanliness was improved and the incidence of disease reduced. This was due to the fact that by removing the smell, they were unconsciously removing the real cause of disease, which was bacteria. Germ theory radically changed the practice of medicine as it enhanced status for laboratory science, and for hospital medicine and surgery. It was Louis Pasteur in 1860s and Robert Koch's scientific studies of microbes causing human diseases two decades later, that provided the scientific proof of germ theory (www.sciencemuseaum.org.uk). This knowledge of bodily functions; organs, organ systems, tissue, viruses and bacteria was defined as biomedicine (Patel et al 1989, cited in Boshuizen and Schmidt 1992: 155). In the biomedical model, disease and illness are regarded as the consequence of certain malfunctions of the human body.

As the sociology of health and illness developed it distanced itself from the biomedical model by stressing the 'socially constructed nature of illness and

medical practice' (Annandale 1998: 14). The biomedical model focused on the scientific physical processes such as the pathology, biochemistry, and physiology of a disease and did not take into account the role of social factors. It viewed health as the absence of disease. Whereas, the social model was interested in the environmental and social causes of ill health. Parsons (1951) with his classic formulation of the concept of the 'sick role', gave life to the budding social model[3].

In medicine, it is important that human beings are not viewed as just bodies, that can malfunction, but are seen as individuals with their own minds, emotions and lifestyles. I suggest that this is why medicine is seen to have two sides to its nature and why physicians still view their profession as 'empirical art'. To appreciate this argument it is necessary to comprehend the fundamental differences between science and art.

Wilson (2008: 58) suggests that science is:

> ... the concerted human effort to understand, or to understand better, the history of the natural world and how the natural world works, with observable physical evidence as the basis of that understanding. It is the organised, systematic enterprise that gathers knowledge about the world and condenses the knowledge into testable laws and principles.

Whereas, art is defined as:

> ... the use of skill and imagination in the creation of aesthetic objects, environments, or experiences that can be shared with others, art is seen a diverse range of human activities, expression and communication of emotions (Encyclopedia Britannica Online).

[3] Parson's model was criticised for strengthening medical power and for not recognising the implications for people with chronic illness. Other sociologists, such as Freidson (1976), Armstrong (1987), White (1991) and Turner (1992) have added their views within medical sociology.

Through these definitions it is clear to see that the two categories are poles apart; the view is that science is based on testable objective principles while art is based on subjective emotions.

In science, there is an expectation about the uniformity of nature therefore scientific laws are based on inductive principles. Williams and May (1996: 22) cite three conditions that must be satisfied in the process of induction:

> First, the number of observation statements forming the basis of the generalisation must be sufficiently large. Secondly, the observation statements must be repeated under a wide variety of conditions and thirdly, no accepted observed statement should conflict with the derived universal law (Chalmers 1982).

They suggest that once these conditions have been met and a 'law' established, it is then possible for the scientist to both explain and predict phenomena. Further, they point out that most scientists will discover a single phenomena and then will reason from specific examples to general principles. These generalisations are on the basis of the probability of their assertions being true. (Williams and May 1996: 24)

The concept of science, for most of us, conjures up an impression of the use of tried and tested knowledge. Many advertisements on the television use the words 'scientifically proven' to reassure us that products are safe to use. Since the economic recession of the 1980s, work has taken place to improve the public's understanding of science. At that time, there was a view expressed by scientists, that society has a whole did not value science. A committee was established called COPUS, Committee on Public Understanding of Science. This committee looked at ways in which to deliver scientific information to the public and to train scientists to deliver their message. Politicians hoped that

once the public knew more scientific facts, they would welcome scientific innovation, for example; genetically modified food crops. This was not necessarily the case, as once the public gained more scientific understanding, they tended to ask more critical questions (Gregory 2001).

In comparison, our concept of art varies depending on what art we are referring to, this may be artwork, crafts or a skill etc.

> It is not at all clear that these words – 'What is art?' – express anything like a single question, to which competing answers are given, or whether philosophers proposing answers are even engaged in the same debate…. The sheer variety of proposed definitions should give us pause. One cannot help wondering whether there is any sense in which they are attempts to … clarify the same cultural practices, or address the same issue (Walton 1977: 98).

To provide some clarity, I feel that this description regarding the activity of art is most useful:

> Art is a human activity consisting in this, that one man consciously, by means of certain external signs, hands on to others feelings he(sic) has lived through, and that other people are infected by these feelings and also experience them (Tolstoy 1897: 60).

As previously mentioned, our concept of science and art are very different. However, there is also seen to be a difference between scientists and non-scientists. Snow (1959: 5-6) mentions two cultures which represent these diverse attitudes. He suggests:

> The non-scientists have a rooted impression that the scientists are shallowly optimistic, unaware of man's (sic) condition. On the other hand, the scientists believe that the literary intellectuals are totally lacking in foresight, peculiarly unconcerned with brother man, in a deep sense anti-intellectual, anxious to restrict both art and thought to the existential moment.

This friction between art and science was recognised in medicine. Trousseau, a French internist when giving a lecture on clinical medicine pointed out:

> Every science touches art at some points every art has its scientific side; the worst man of science is he who is never an artist, and the worst artist is he who is never a man of science. In early times, medicine was an art which took its place at the side of poetry and painting; today they try to make a science of it, placing it beside mathematics, astronomy and physics (1869: 40).

The debate as to whether medicine is a science, an art or both is ongoing; e.g. see Decyk (1996), Hegde (1999), Saunders (2000) and Warsop (2002). Panda (2006: 136) sums up these debates and concludes:

> Medicine is both an art and a science. Both are interdependent and inseparable, just like two sides of a coin. The importance of the ***art*** of medicine is because we have to deal with a human being, his or her body, mind and soul. To be a good medical practitioner, one has to become a good artist with sufficient scientific knowledge. Technology covered with the layer of art alone can bring relief to the sick.

Here, Panda encapsulates the *art* of medicine as an amalgamation of the biomedical and social models. He acknowledges that medicine has to deal with human beings as a whole, by addressing biological malfunctions through the use of scientific knowledge and technology, whilst being aware of the multi-causal social factors present in disease.

In summary, I concur with this view. However, one of the most recent scientific developments, the Human Genome Project, where all the genes in human DNA have been identified, will have a huge impact on medicine through:

- Improved diagnosis of disease
- Earlier detection of genetic predispositions to disease
- Rational drug design

- Gene therapy and control systems for drugs
- Pharmacogenomics "custom drugs"

And on clinical practice:

> The molecular medicine perspective emphasizes cellular and molecular phenomena and interventions rather than the previous conceptual and observational focus on patients and their organs (Massound and Gambhir (2007: 185).

(Labisch 2000: 9-32) expressed the view, that ‘the reason why medicine would never become a pure science, was that it concerned patients who needed to be considered as individual subjects’. The Human Genome Project provides a focus on individual subjects, but I propose that this focus will be pharmacologically based and still needs to account for the individual patient as a complex human being with individual variations in their genes and lifestyles.

In the art of medicine, subjective experiences of emotions are sensed by fellow human beings and judgments are made. I use my following scenarios to illustrate this:

> a physician when gaining a patient’s history, senses something is not quite as it seems and uses his/her clinical skills to delve further.
>
> or
>
> a patient presents feeling desperately unwell and the physician or another health professional feels the patient’s emotion and will assume a calming nature that will transfer to the patient to reassure him/her.

These skill are attained by study, practice and observation but also arises from intuition. They inform the physician’s clinical practice and judgement. In the

case of the pharmacological approach in future molecular medicine, the art of clinical practice and judgement will be even more important in the form of reassurance/support regarding genetic disease/conditions and the recognition of any underlying ailments (WHO, 2007).

Patel et al (1994) sum up the role of art and science in clinical practice:

> The science of medicine in clinical practice sees the physician as correlating or applying principles in an axiomatic or deductive fashion to a patient's symptoms, yielding a precise diagnostic solution. The artistic approach involves the use of intuition, experience, and holistic perceptions in making clinical judgements and in the delivery of humane care. Traditionally, the scientific dimension is viewed as the application of explicit knowledge, and the more intuitive artistic side draws on tacit knowledge. Although there is some truth in this distinction, the actual boundaries are much harder to delineate

2.2.2 Tacit knowledge

As previously mentioned, the artistry side of medicine is seen to draw on tacit knowledge. The term 'tacit knowledge' was first described by Polanyi (1966: 4) who mentioned 'we can know more than we can tell'. He proposed that tacit knowledge is difficult to communicate and is often acquired through practice and experience. He described two dimensions of tacit knowledge; technical and cognitive. The technical dimension was seen as 'know how'; our informal personal skills. The cognitive dimension consisted of our mindset and our belief and values, which shapes the way we see the world. Therefore tacit knowledge is seen to be personal, practical and context specific, to the extent that even the knowledge holder may not be aware of its existence.

Other views on tacit knowledge have been expressed. Tacit knowledge has been described as knowledge that cannot be communicated (von Krogh and

Roos 1995; Baumard 1999); knowledge that is difficult to make explicit (Nonaka et al 1994) and regarded with explicit knowledge as extreme poles on a continuum with the possibility of moving tacit to the explicit end (Davenport and Prusak 1998).

Collins (2010: 85) argues that tacit knowledge seems problematic because of the focus on explicit knowledge, 'if it were not for the idea of explicit we would never have noticed that there was anything special about the tacit – it would just be normal life'. He reformulates the explicit in terms of strings and things, describing strings as 'bits of stuff inscribed with patterns, that they are not meaningful and that a string is simply anything that is neither random nor featureless' (Collins, 2010: 16). The information content is a physical feature of a string, that refers to the number and arrangement of its elements. These elements can include numbers, alphabet letters, binary codes, patterns on wallpaper and notes of a songbird etc. Confusingly, Collins explains that elements of a string can also be strings in themselves and vice versa, also strings are just entities and that they sometimes interact with entities.

Strings can be digital or analogue. Digital strings are broken down into a set of explicit steps or patterns without loss of information, and can be wholly explicit. In contrast to analogue strings who depend partly on their physical properties, the pattern in analogue require some social knowledge or understanding that affords their interpretation in one way or another.

The concept of strings becomes slightly clearer when Collins explains how strings can affect entities (Collins 2010: 17):

Diagram 2.1 – How strings affect entities.

1	2	3 and 4	
PHYSICAL IMPACT	INSCRIPTION	COMMUNICATION	
		3	4
		Mechanical	Interpreted

He provides the following description for the table:

1. A string is a physical thing, so it can have a physical impact.

2. A string is a pattern, so it can impress, print or 'inscribe' a similar pattern on an entity in many different ways.

3 & 4. A string can change an entity in a more fundamental way than mere inscription – it can cause it to do something or give it the ability to do new things that it could not do before. This communication can be done in two ways: (3) a string can communicate 'mechanically', as when a new piece of code is fed into a computer or a human reacts to a sound in a reflex-like way; and (4) a string can communicate by being interpreted as meaningful by a human.

Collins (2010: 81) focuses on what we can do with strings and provides four meanings of how knowledge can be made explicit:

Table 2.1 – How knowledge can be made explicit

1. Explicable by elaboration	A longer string affords meaning when a short or does not.
2. Explicable by transformation	Physical transformation of strings enhances their causal effect and affordance.
3. Explicable as mechanisation	A string is transformed into mechanical causes and effects mimic human action.
4. Explicable as explanation	Mechanical causes and effects are transformed into strings called scientific explanation.

Three types of tacit knowledge have been proposed, relational, somatic and collective. Relational tacit knowledge is sometimes referred to as concealed knowledge, this where ‘parties could tell each other what they need to know but either will not or cannot for reasons that are not profound, such as not knowing what the other party needs to know’ (Collins 2010: 91). An example of relational tacit knowledge from my clinical perspective could be, a patient is admitted with shortness of breath. The physician does not ask the patient if they smoke and the patient does not volunteer this information. The patient may have omitted the information on purpose, as he/she feels guilty for smoking or may have thought that the physician would have ask him/her the question if he/she thought it relevant.

On the other hand, somatic tacit knowledge comprises knowledge that is tacit because of the human body’s physical properties or limitations. Henry (2011: 15) provides an example of this from a clinical perspective:

> Suppose that the presence or absence of a patient's rash depends on two factors: subtle changes in body temperature and small fluctuations in serum antibody concentrations. The patient will be unable to tell the doctor exactly when her rash started or how it has changed over time. This is because a) human memory is fallible, b) humans have a limited ability to perceive subtle changes in their peripheral body temperature, and c) humans have no ability to perceive changes in their serum antibody concentrations. Doctors might, however, construct a sophisticated machine to continuously measure antibody concentrations, body temperature, and the presence or absence of skin rashes. Such a machine could make explicit the knowledge of how the patient's rash changes over time and perhaps even lead to a mathematical equation that predicts her rash based on body temperature and antibody concentrations. Somatic tacit knowledge, like relational tacit knowledge, is not mystical and can be made explicit in principle (e.g., through the construction of a temperature-and-antibody-measuring machine).

Finally, collective tacit knowledge is seen to comprise of knowledge that is tacit because it depends on social and cultural judgments that depend on context and so cannot be generalized in explicit terms (i.e. transformed into digital strings).

Haldin-Herrgard (2002: 10) suggests that 'although the main characteristic of tacit knowing is tacitness as abstraction, it can be seen that extents on abstraction vary from completely abstract to quite concrete in the concepts used'. His table below shows this view:

Collective	Common sense.	Culture.	Best Practice.
	Common belief.	Collective know-how.	
	Shared norms.	Common experience.	
	Organisational memories.	Collective ability.	
	Shared meeting.	Shared values.	
	Shared code	Social institution.	
Individual/ team	Cognitive schemes.	Non analytical behaviour.	Life examples.
	Unconscious norms.	Automatic knowledge.	Creativity.
	Mental models.	Experience.	Skills.
	Attitudes.	Knowledge base.	Pattern of experience.
	Opinions.	Values.	Improvisation.
	Inexplicable mental process.	Perspective.	Tricks.
	Understanding.	Judgement.	Estimation.
		Rule of thumb.	Routines.
		Routine knowledge	Techniques.
Individual	Intuition.	Skills - Bodily - Cognitive - Inductive - People.	Sense making.
	Feeling for.		Intuitive reaction.
	Beliefs.		Artistic vision.
	Hunch.		Ability.
	Gut feeling.	Intuitive knowledge.	Skills – physical and social.
	Emotional knowing.	Flash of insight.	Crafts.
	Flashes of inspiration.	Care – why.	After the fact awareness.
	Feel as.	Know how.	Master sureness of action.
	Sound as.	Second nature.	Skilful.
	Looks as.	Talent.	
		Practical intelligence.	
ABSTRACT →			**CONCRETE**

Table 2.2 - Commonalities regarding to abstraction and actors (Haldin-Herrgard (2002: 10)

The table above shows the aesthetic nature of tacit knowledge, however, the characteristics in the ‘concrete’ column still remains fairly abstract, for example; words like skilful, awareness etc, still remain difficult to measure.

Tacit knowledge is summed up in the following quote:

> By its very nature, tacit knowledge can never be measured, but can be revealed in practice (Cook and Brown, 1999: 382).

2.2.3 Evidence-based medicine

In evidence-based medicine, the physician is provided with scientific knowledge to inform his/her art of clinical judgement. As mentioned previously, the science of medicine has been developing rapidly over time. However, up until the early 1970s, there was no formal scientific approach to how and why clinical decisions were made and their effect on patient management. Medical practice was underpinned by biomedical knowledge, but it was unclear as to how or if this knowledge played a part in actual clinical decision making. Questions were being asked about the 'validity of using traditional clinical authority as the basis for clinical decision making, as there were no grounds for appeal except by reference to the very authority that was being questioned' (Daly 2005: 1). Most treatment related decisions were based on an adhoc selection of information, either from the vast and variable quality of scientific literature available, on expert opinion, and/or in some cases just trial and error. This situation led to Cochrane, a British epidemiologist, proposing that 'researchers and practitioners should collaborate internationally to systematically review all the best clinical trials (that is randomised controlled trials) speciality by speciality' (Glasziou et al 2003: 4). The randomised control trial is a causality generative process of objective probability where a hypothesis is either accepted or rejected.

The first published randomised control trial appeared in 1948 and was entitled *Streptomycin treatment of pulmonary tuberculosis*. By the late Twentieth century, randomised control trials were providing a solid basis of scientific evidence for clinicians to practice evidence-based medicine. It was proposed that the 'ideals of evidence-based medicine; clinical guidelines, should be based on scientific evidence preferably a meta-analysis of randomised clinical trials

offering probability estimates of each outcome' (Timmermans and Berg 2003: 3). The randomised control trial was seen as the 'gold standard' in research evidence. As Hamer and Collinson (2005: 22) remark, 'it has an experimental design that seeks to manipulate a variable within the trial, with a group used as a control for which that variable is not manipulated'. The element of bias in these studies is minimised through the researchers only having coded identifiers for the participants involved. The study seeks to ensure that any effects observed are, as far as possible, known to be due to the intervention. This approach is also used in drug trials to gauge the effect of a drug on people. In this method, a group of people are selected; they are then randomised and placed into two groups; one group, the active group and one group the controlled group. The drug being trailed is given to the active group and the control group are given a placebo. The outcome effects from the people in the two groups is monitored over time and recorded. The results then give the objective probability of the effectiveness of the drug as well as the objective probability of side effects.

This notion is challenged by Byrne (2002: 93) who argues that 'the RCT is a useful but limited approach which can only be employed if the relationships being investigated are not characterized by the interaction and emergence which dominates the open system of social and biological reality'. I interpret this to mean that the usefulness of the trial is limited by the fact that many other factors, such as environment and human individuality, which have properties that are difficult to explain in terms of their components, will inevitably influence the outcome. I concur with this view, for example in the case of tuberculosis, environmental factors and diet played a role in treatment outcomes.

Nevertheless, the randomised control trial still holds an elevated position in a table devised by *The Centre for Evidence-Based Medicine*, at Oxford University, using the following hierarchical levels of evidence:

Level of Evidence	**Evidence**
1a	Systematic Review of Randomised Control Trial.
1b	Single Randomised Control Trial.
1c	All or none.
2a	Systematic review of cohort studies.
2b	Cohort study or poor randomised controlled trail.
2c	Outcome research.
3a	Systematic review of case – controlled studies.
3b	Case – control study.
4	Case series.
5	Expert opinion, physiology, bench research.

Table 2.3 – Evidenced based medicine. Cited in Doherty(2005: 309)

There has been some debate regarding evidence-based medicine, in particular the elevated position of the randomised control trials in comparison to the physicians' gathering of clinical information and scientific knowledge. This is shown in Doherty's challenge to the belief that evidence-based medicine was identical to random control trials. Doherty viewed evidence-based medicine as an 'evolutionary progression of knowledge based on the basic and clinical sciences and facilitated by the age of information technology' (2005: 312). Whereas, Sackett et al (1996: 71) writing in the *British Medical Journal*, defines evidence-based medicine as:

> ... the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.

As we can see, this definition incorporates the art and the science of medicine interdependently, as mentioned in Chapter 2.2.

A view proposed by Than et al (2005: 330) is that many clinicians find that these systematic reviews and the guidelines that follow, do not necessarily relate to the individual patient. The recent surge of interest in personalised medicine can be seen to overcome this problem, as it uses an individual's genetic profile, to help doctors to select the proper medication or therapy and administer it using the proper dose or regime. Than et al (2005:330) suggests that an evidence-based medical clinical practitioner would be best to define themselves as 'a person who progressively equips himself/herself with special skills that include finding, accessing, interpreting and applying scientific information, in order to assist in making more immediate and local medical decisions'. Sackett et al (1996: 71) make a similar point, by suggesting that

> ...good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannized by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient. Without current best evidence, practice risks becoming rapidly out of date, to the detriment of patients.

Although there is a general acceptance of the use of evidence-based medicine, there have also been many critics: It has been accused of being authoritarian; of privileging a narrow definition of evidence; and of having serious limitations in

its capacity to answer clinical questions (Feinstein and Horwitz 1997). It stands accused of amongst other things of denigrating clinical experience (Benech et al 1996) and aligning itself with managed care[4], a party to coercion, control and covert rationing (Hunter 1996; Frankford 1994) (Daly 2005: 2).

Drawing on these views, Trinder and Reynolds (2000: 30) suggest

> ... that the concerns regarding evidence-based medicine appear to fall into three categories; firstly that 'it provides a structure within which to ration healthcare'; secondly, the fear that 'it threatens the professional autonomy of individual doctors' and that it 'presents a distorted and partial view of science and rejects much that is central to the scientific method.

I suggest, that some of these concerns are reasonable and to some extent corroborated. An example of this, is the work undertaken by the National Institute of Clinical Excellence (NICE)[5] . NICE does control elements of clinical practice through its published evidence-based guidelines and rations healthcare through its work on best value for the use of NHS money.

When it comes to clinical practice, the practical use of evidence-based medicine is challenging and limited. Physicians need to find the relevant information and keep up to date with the literature. They also need to ensure that their information is from a reliable source. According to Hammer and Collinson (2005: 9) 'for many practitioners, not to act because the evidence is weak or

[4] Managed care – A system mainly used in America which uses techniques to control the cost of providing healthcare by proposing that the health-care industry becomes more efficient and competitive.

[5] The National Institute for Health and Clinical Excellence (NICE) was set up in 1999 to reduce variation in the availability and quality of NHS treatments and care - the so called 'postcode lottery'. The evidence-based guidance and other products help resolve uncertainty about which medicines, treatments, procedures and devices represent the best quality care and which offer the best value for money for the NHS.

non-existent is certainly not an option. Evidence-based medicine is seen to enhance clinical judgement but not replace it. Friedland et al (1998) suggest that there are three components to evidence-based medicine, these are; medical decision making techniques, accessing medical information and assessing the validity of medical information. Higgs and Jones (2000: 313) argue that the other important challenge for physicians is how they use the information. They propose that there is a need for physicians to have skills in reasoning, to enable them to integrate new knowledge into existing knowledge. This includes 'knowing when and how to use that knowledge'.

For this reason, evidence-based medicine forms as a key part of the teaching curriculum for medical students. It is seen as having five key components, these are:

1. Converting clinical problems into answerable questions,
2. Searching for and finding the best evidence to answer the questions,
3. Critically appraising the evidence (also known as trashing the papers),
4. Applying evidence to their everyday practice,
5. Auditing or evaluating their practice (Dalton et al 2005: 3).

It is hoped that by educating medical students to use evidence-based medicine in medical school, that these skills will be transferred into their clinical practice. This was proposed by Sackett et al (1996: 71) who suggested that the evolution of evidence-based medicine would be 'enhanced as several undergraduate, postgraduate, and continuing medical education programmes adopted and adapted it to their learners' needs'.

In Chapters 5 and 6, I report how my research shows how science and the art of medicine are used interdependently by physicians during the medical

diagnostic process. I discuss these physicians' personal views on evidence-based medicine and how they blend their clinical reasoning with evidence-based medicine in a clinical setting.

2.3 Medical education / training

The greatest deficiency of medical education throughout the 20th Century was seen to be the failure to train students properly for clinical uncertainty (Fox 1980). Ghosh (2004: 48) suggests that 'uncertainty in diagnosis is frequently encountered in medical practice and causes stress in patients and physicians. Factors contributing to uncertainty include biological variability of patients, patient and physician bias, error in test interpretation, differing values and opinions of patients and physicians, and uncertainty surrounding decision-making'. Schon (1990) found that medical students and junior physicians had particular difficulty in tolerating uncertainty. He suggested that they wished to resort to rule-based knowledge to compensate for their lack of experience. Lingard et al (2003) suggest that the development of doctors' thinking is facilitated by the build up of scientific knowledge which informs clinical reasoning, so that they can manage uncertainty. In Chapters 4 and 5, we see how the knowledge physicians gain through clinical experience provides them with the confidence to manage similar clinical situations, thereby managing this uncertainty. Reaching a diagnosis has been conceptualized as a process of reasoning about uncertainty, updating an opinion using imperfect information (the clinical evidence). As new information is obtained, the probability of each diagnostic possibility is continually revised. Each 'pre-test probability becomes the post-test probability for the next stage of the inference process' (Elstein 1999: 791). This description fits with the hypothetic deductive model of clinical reasoning which is discussed further in 2.5.2.6 of this chapter.

During the clinical skills training that takes place in medical education, making the right diagnosis does not appear to be the most important aspect. The emphasis seems to be concerned with the methodical approach taken by a medical student in reaching a diagnosis (Dalton 2005). This is illustrated when looking at the *Objective Structured Clinical Examination (OSCE)* which is used by most medical schools worldwide, in one form or another, as part of the final examination for the Bachelor of Medicine qualification.

An example of a typical OSCE tick box mark sheet:

Q. This patient has been breathless. Examine his cardiovascular system. What is the differential diagnosis and how would you investigate him?			
		Total possible marks	Sub- totals
Introduction	Student introduces themselves to patient and asks permission	1	1
Attitude	Student has professional attitude to patient and examiner	2	2
Examination	• Peripheral pulses and peripheral oedema • Blood pressure • JVP and carotids • Precordium • Lung bases • Liver and aortic abdominal aneurysm	1 1 1 2 1 1	7
Presentation	• Findings presented in an articulate and logical manner • Positive and relevant negative findings appropriately emphasised	2 1	3
Differential Diagnosis	Accurate differential diagnosis • Aortic stenosis • Aortic sclerosis	4	4
Investigations	Appropriate investigations in sequential order: • ECG • CXR • Echocardiograph	1 1 1	3
	Total		20
	(pass mark = 10)		

Table 2.4 - OSCE sheet (Dalton 2005)

In the last few years, medical education has undergone change. This has been necessary to ensure that physicians can adapt to changing societal expectations and are better prepared to meet the needs of their patients. The change has been in response to several factors, such as:

- definition of the role of the physician
- improved working hours through the European working time directive
- the changing demographics of the population (many people now being aged over 65 years: 19% of the population in UK)
- the shift to patient-centred care
- changes to education through the use of technology taking on a more learner centred approach
- economic changes within the country affecting the NHS and other public services.

A recent survey in response to the General Medical Council[6]'s consultation on the future educational requirements for medical students showed that many consenting participants felt that the main area of difficulty for junior doctors was their lack of confidence and competence in clinical decision making and prescribing, through a lack of experience in clinical situations. Following the consultation process, the General Medical Council published a document titled *Tomorrow's Doctors* (2009) which states 'the doctor as a practitioner needs to be able to make an initial assessment of the patient's problems and a differential diagnosis; to understand the processes by which doctors make and

[6] The purpose of the General Medical Council is to protect, promote and maintain the health and safety of the public by ensuring proper standards in the practice of medicine. One of their core legal functions is to regulate medical education and training so that patients now and in the future can be confident that they will receive safe, high quality medical care.

test a differential diagnosis ... to make clinical judgments and decisions based on the available evidence' (GMC 2009: 20).

Following their medical education/training, a medical graduate is expected to apply biomedical scientific principles, method and knowledge to medical practice and explain the scientific bases for common disease presentations, diagnoses and manage clinical presentations. S/he has to be able to carry out individual consultations with patients by:

- Taking and recording a patient's medical history, including family and social history and talking to relatives or other carers where appropriate.
- Performing a full physical examination.
- Performing a mental state examination.
- Providing an explanation, advice, reassurance and support.

S/he has to be able to diagnose and manage clinical presentations by:

- Interpreting findings from the history, physical examination and mental state examination, appreciating the importance of clinical, psychological, spiritual, religious, social and cultural factors.
- Making an initial assessment of a patient's problems and a differential diagnosis.
- Formulating a plan of investigation in partnership with the patient, obtaining informed consent as an essential part of this process.

- Interpreting the results of investigations.
- Synthesising a full assessment of the patient's problems.
- Formulating a plan for treatment, management and discharge, according to established principles and best evidence, in partnership with the patient, their carers, and other health professionals as appropriate. Responding to patients' concerns and preferences, obtain informed consent, and respect the rights of patients to reach decisions with their doctor about their treatment and care and to refuse or limit treatment.
- Supporting patients in caring for themselves (GMC 2009: 29-30).

It is clear to see that these GMC competencies, place the patient at the centre of the development of a physician's medical practice.

2.4 Patient/physician interaction

During the 18th Century, many 'bouts of illness were handled from beginning to end, personally by the sick individual or within his (sic) affected group of family, friends and neighbours' (Porter and Porter 1989: 70). The decision to call a doctor depended on three factors, the ability to pay, personal preferences and the patient's perceived seriousness of their illness. Norton (1956) suggested that:

> It would be a major mistake to assume (as old-fashioned medical historians did) that the early modern medical practitioners were few and far between, and that only the well-off could afford them (most of the populace being left to fend for themselves, or to resort to the ministrations of witches, layers-out, wise women and other amateurs (cited by Porter and Porter 1989: 17).

For the poorer sick people some physicians held charity surgeries, others used a sliding scale payment based on the person's ability to pay. These sick people would queue up outside the physician's door early in the morning. Whereas, the wealthy expected house calls as their right and formed a relationship with their physicians (ibid).

The consultation between the sick person and the physician took the form of the sick person telling the physician what they thought was wrong with them, and the signs and symptoms they were experiencing:

> The patient would recite, perhaps spontaneously, perhaps on demand, the main features of his (sic) lifestyle: his eating habits, the quality of his sleep, his bowel motions, details of recent emotional traumas and so forth, not to mention the perhaps slightly indelicate matter of his indulgence in home-made, quack or patients medicines (Brody 1987 cited by Porter and Porter 1989: 74)

The physician would listen to this history and then undertake a visual examination, looking at their skin colour, any blemishes or rashes. The physician did not touch the patient other than to feel his/her radial pulse. In the 19th Century, the physical examination developed through the advancement of technology. This development diminished the patients' participation in the physician/patient interaction, as it gave rise to a 'new concept of the body' the dehumanising medical separation of the patient's body from the patient's person, termed by Foucault as the 'medical gaze' (Foucault 1976: 89). As a result of technical advances, the doctors could 'look' inside the body and identify the site of infection without needing the active participation of the patient (Armstrong 1995). In fact, it was felt that the stethoscope could only be used if

the patient remained still and silent. The examination often involved the patient removing their clothes, laying down and being still in a manner resembling that of a corpse. Involvement in the diagnostic process was confined to mechanical instructions like' take a deep breath' or 'move a limb'. From a patient's perspective Lachmund (1998: 789-801) suggests that:

> Patients had to learn to comply with these procedures technically and they had to accept them as moral and beneficial. This was a process of re-negotiation of the deeply entrenched modes of interaction between doctors and patients.

Parson's (1951) was the first sociologist to theorise the doctor/patient relationship. He emphasised the social aspects of the medical encounter. However, this encounter was seen as being dominated by the doctor (Chapter 1. 2). Later technology developments such as laryngoscopes and microscopes further marginalised the role of the patient as an active participant in diagnosis (Reiser 1978). Physicians were seen to have the power of science to find the hidden truth of disease and illness. Engel (1977) while acknowledging the benefits of the scientific advancements in medicine, criticised its narrow perspective and the way in which it dehumanised medicine and disempowered the patients. He offered a new biopsychosocial model which suggested that biological, psychological and social factors all played an important part in understanding illness and disease.

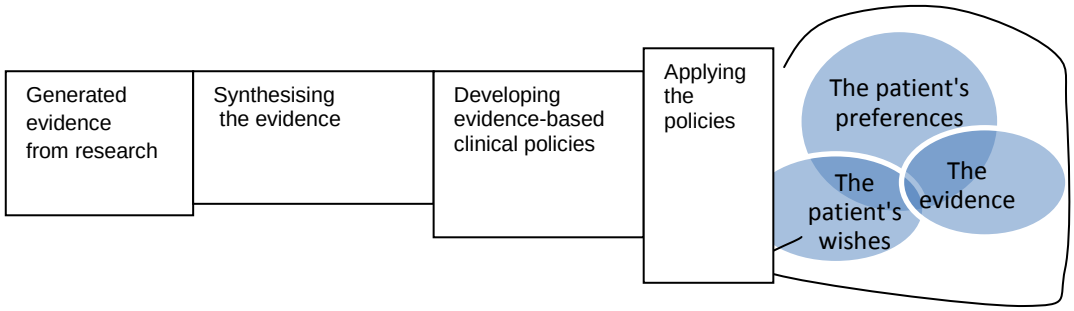
The imbalance between the patient and the physician has been challenged over the years and as medical technology has advanced, so have other forms of technology, such as, telecommunication systems. This has led to an improvement in patient information and knowledge (Malik 2005). An example of

the way in which information and the use of information has developed is summed up in the following quote:

> Information about health, illness and treatment options is more widely available than ever before. Developments in information technology make it easier for lay people to access research that was formerly accessible only to those undergoing professional education and training. Professional closure is no longer absolute in terms of access to the information on which professional authority is built. At the same time, health user groups and social movements are generating their own sources of information, which sometimes provide alternative perspectives from those offered by health professionals (Barnes 1999: 12).

This information places the patient in a more influential role, where their involvement is seen as necessary for a mutual responsibility in healthcare decisions. Therefore, a shift in emphasis towards patient-centred care has occurred (NHS 2009). It is now expected that the physician openly discusses issues with the patient and that the patient shares in the decision making process, thereby integrating clinical experience with patients' values and the best available clinical evidence (Charles et al 1997. Makoul and Clayman 2006. Elwyn et al 2000) This model is illustrated in Diagram 2.2.

Diagram 2.2. Path from the generation of evidence to the application of evidence in clinical practice



Making clinical decisions (Adapted from source, Haynes and Haines cited by Glasziou et al (2003).

The importance of the patients' wishes and preferences are recognised by GMC

(2010) in its guidance for good practice for registered doctors. The guidance states that the doctors should work in partnership with patients by; listening to patients and responding to their concerns and preferences, giving patients the information they want or need in a way they can understand, respecting patients' right to reach decisions about their treatment and care by supporting patients in caring for themselves to improve and maintain their health.

The first and often the most important part of a physician/patient interaction concerns taking a patient's history. This is due to physicians needing to gather as much information as possible on which to base their diagnosis. In a short space of time they have to learn about the patients as people and how they have experienced their symptoms and illnesses, while establishing a trusting relationship. Bates (1995) suggests that the interaction that takes place between the physician and the patient requires the physician to use the skills of facilitation, reflection, clarification, emphatic responses, confrontation and interpretation. This view is supported by Bleakley et al (2011: xii) who suggest that the best physicians:

> ... listen very closely and respond attentively to patients at a variety of levels, including the technical, ethical and human and that 'good doctors read and respond to patients using a practice known as *close reading of the patient* and often talk about 'reading' the symptoms, signs and indications that the patient communicates both consciously and unconsciously' and that this " twin act of sensibility and sensitivity can be seen as a type of literary awareness"...

And:

> Literature deliberately sets out to make us think in ways other than the merely obvious. Importantly, literature can help us to think the unthinkable and imagine the unimaginable. Experienced doctors know how important these ways of thinking really are in helping them to deal with the uncertainty that is fundamental to medicine. Like poets and writers, they know that what you can see on the surface is only a part of

> the story and that what is not there – unseen, unsaid and unfelt – is also important (Bleakley et al 2011: xii).

Building on this narrative approach, Kalitzkus and Matthiessen (2009: 84) suggest that physicians require the following skills:

- Sensitivity for the context of the illness experience and the patient-centred perspective.
- Establishing a diagnosis in an individual context, instead of merely in the context of a systematic description of the disease and its aetiology.
- Narrative communication skills, such as exploring differences and connections, hypothesizing, strategizing, sharing power, reflection active listening, and circular questioning (a technique originally from systemic family therapy) aiming at a differentiated view on a specific topic; it can include questions that are ranking, speculative, relational or contextualizing.
- Self-reflection.

In Chapters 4,5 and 6, I show and discuss the significance of the patient/physician interaction in the diagnostic process. My taped narratives of these interactions provides an interesting insight into the way in which physicians' addressed the patients and the way in which the patients responded.

2.5 Medical diagnosis

Physicians take the lead role in the diagnosis of illness/disease in a medical setting. The medical diagnostic process requires a physician to attribute a probable cause for a patient's illness/disease. Aggleton and Chalmers (2000) suggest that according to the medical model, the patient is seen as a complex set of anatomical parts and physiological systems. It is suggested that 'to solve

a clinical diagnostic problem means first to recognise a malfunction and then to set about tracing or identifying its causes. The diagnosis is thus an explanation of disordered function, where possible a causal explanation' (Elstein and Schwartz, cited by Higgs and Jones 2005: 95).

The pursuit of causal explanation and the reason why we need to identify cause has been long-standing within social science. As Simon (1968: 355) suggests:

> The success of social intervention policies and the consequent credibility of social science depend on our knowing what the mechanisms are by which one variable changes another variable. We cannot make changes without understanding the reasons for a change having one effect rather than another and the conditions under which the change we want may occur. We have, therefore, practical as well as theoretical interests in the "why" of social life.

A couple of everyday practical examples of this interest in the 'why' of social life, could be; when there is a change in a child's usual behaviour or when you have a problem with a practical task.

For the change in a child's behaviour, we may ask the question *why is my four year old suddenly playing up?* We then try to identify a cause for the change in his/her behaviour. Did s/he eat too many sweets with E numbers? or is s/he bored? By trying to identify the cause we seek to improve the situation, either by stopping the child eating sweets with E numbers in them or by entertaining them more.

For the problem with a practical task, we may ask the question *why is this newly applied wallpaper not sticking to the wall?* Has the wrong paste been used? Was the wall damp? Was the wallpaper soaked long enough before applying it

to the wall? Again, by trying to understand the cause we hope to remedy the situation.

In everyday life, most people attribute cause to situations and events in their everyday lives. We can all give an account of an event that we feel was caused by something else, for instance, 'he was driving his car so fast that he caused an accident', 'she smoked forty cigarettes a day and suffered cancer of the lung'. In this way, we are explaining in our own way, why we think some event/effect has occurred. It is the same when we are ill. If we get the flu, we assume that it was caused by associating with someone else who had a cold or the fact that we used public transport last week and caught some 'germs'.

We assume that one event causes another event to happen and that events happen in a sequence. Nevertheless, do we make that assumption based on previous experience of a situation, when we have seen two events linked together, for example; fast driving being responsible for a car accident or knowing someone who smoked heavily and suffered lung cancer? If we examine particular events more closely, we find that the attributed cause given for a specific outcome O can be disputed as a generic cause of O type outcomes. Not everyone who drives a car too fast causes accidents, in the same way as some people who smoke forty cigarettes a day live a long life without contracting lung cancer. Not everyone who associated with the person who had a cold or travelled at the same time as you on public transport got the flu. Therefore, how can we state, that we definitely know that the man driving the car too fast caused the accident or the reason that the woman suffered cancer was because she smoked forty cigarettes a day or that travelling on public transport caused you to get flu? We can see that fast driving, excessive

smoking and travelling on public transport could be contributing factors in each case and probable causes but we cannot with any certainty, say that they were definitely the actual cause.

In relation to clinical practice and research, when discussing in detail what causality meant, Kramer and Lane (1992) cited by Herman (2001: 42-46) suggested that:

> ...the truth or falsity of a . . . (retrospective) . . . causal proposition depends on what would have happened in the alternative world, which is inherently unobservable . . . causation inevitably involves a subjective inference about what might have been in the absence of a putative cause.

Thus:

> Smoking caused John's lung cancer, but it can never be proven. Because we cannot reconstruct the world in which John did not smoke. Moreover, in John's case, we are dealing with an individual rather than an exposed group(cited by Herman 2001: 42-46).

Let’s look at the example of a patient admitted to hospital with the presenting complaint of chest pain. The physician has to form an impression/working diagnosis of what is/has caused the chest pain. Chest pain can be caused by many different factors. The physician’s diagnosis is based on information gathered during the medical diagnostic process and the physician’s clinical reasoning. The physician then makes a clinical decision on the diagnosis of a probable cause of the chest pain.

2.5.1 Medical diagnosis – prevalence of errors

It is suggested that the first step to optimal care is making the right diagnosis (Scott 2009). However, the prevalence of errors in making the correct diagnosis are worryingly high. Scott (2009) acknowledges that the correct diagnosis is

missed or delayed between 5% and 14% of acute hospital admissions; that 20% and 30% of administered investigations and drugs are potentially unnecessary and that even if the diagnosis is correct up to 45% of patients with acute or chronic medical conditions are not receiving recommended evidence-based care. He notes that most errors in the physicians' clinical reasoning were not due to incompetence or inadequate knowledge, but to the frailty of human thinking under conditions of complexity, uncertainty, and pressure of time. Other studies on adverse events in hospital patients support this argument and suggest that reasoning errors have accounted for many patients receiving an incorrect diagnosis and subsequent mis-management and treatment (Wilson et al 1999).

Many writers concur with these views. For example, Croskerry (2003) suggests that the clinical reasoning and decision making process during the medical diagnosis show considerable vulnerability to error, especially when the cause of the illness/disease is uncertain. Riegelman (1991) argues that errors are due to errors of ignorance or errors of implementation. Simply put, errors are caused by the physicians' lack of knowledge or how the physicians applied their knowledge. While, Newman-Toker and Pronovost (2009) acknowledge that diagnostic errors were thought to originate with some physicians, through a lack of training or skill, they propose that the solution to reduce diagnostic errors will require a more systematic approach. The following is an example given was appertaining to emergency departments in America:

> Triage protocols in emergency departments often categorize patients with typically benign symptoms, such as isolated headache, as being at "low-risk" of having a bigger problem, even though such symptoms are sometimes indicative of dangerous conditions, such as a bleeding brain aneurysm. A systems fix that could decrease diagnostic errors might be to change the overall rules for the triage protocol so that it considers

specific symptom details that help distinguish between “low-risk” and “high-risk” types of headache (Newman –Toker and Pronovost 2009: 1060-62).

Newman-Toker and Pronovost suggest ‘adopting tools such as checklists that help physicians remember critical diagnoses or by making available computer programs known as ‘diagnostic decision-support systems that assist physicians in calculating the level of risk of a given patient’s having certain diseases’. A similar solution has been proposed by Schiff and Leape (2012: 135) whilst acknowledging that the diagnostic process is error prone. They propose a ‘six-part checklist for the top twenty to thirty clinical symptoms or problems to minimise diagnostic errors’:

List 1
Diagnostic Essentials: Elements of a Checklist for Minimizing Diagnostic Errors in Medicine **Essential data elements** Specific elements of history, physical examination, and testing data that should be reliably obtained for every patient presenting with a given symptom. In many situations, patients can reliably provide history elements with a computer-assisted questionnaire. **Don’t-miss diagnoses** Critical diagnoses that can present with particular symptoms that are or have serious consequences if they are not recognised and treated promptly. These diagnostic possibilities should be considered in every patient with such a symptom. **Red-flag symptoms** Specific associated symptoms or findings (e.g. back pain with new urinary incontinence in a cancer patient) that may indicate a serious condition and should lead to heightened suspicion of and evaluation for a don’t miss diagnosis. **Potential drug causes** Medications that can cause that symptom (or a disease manifesting that symptom). A fraction of patient symptoms are medication side effects, yet medications are frequently not considered as a possible cause for symptoms. For this reason, medications need to be put at the top of the differential diagnosis for any unexplained symptoms. The computer should be able to assist in matching patients’ medication profiles with adverse effects. **Required referral** When specialist expertise or technology is needed to adequately and safely evaluate the patient. Such cases may include possible rare conditions with which only specialists have sufficient experience, or conditions for which required testing(such as a biopsy or endoscopy) necessitates such a referral. **Patient follow- up instructions and plan** Warnings that patients should receive regarding specific symptoms that should lead them to return or call. These should be in writing and include a time frame (e.g. Call if you develop rash or fever or if you are not improved in 48 hours). Table 2.5 - Diagnostic Essentials Schiff and Leape (2012: 137).

I have found that the vast majority of literature published regarding medical diagnostic errors is American. I assume that this is due to a large portion of the American healthcare system being market based, which means that it is funded privatively through health insurance, either through employers or individuals. In the case of a suspected diagnostic error, the hospital employing the physician or the individual physician is taken to court by a patient or his/her family. The case is then dealt with through their litigation system and Tort[7].

Some of the issues raised here will be discussed in Chapter 6. However, it is worth noting that the use of the proposed checklists is quite dependent on an automated care system. In this country, although primary care services (GP surgeries) are automated, many areas of secondary care are not.

2.5.2 Causality, clinical reasoning and clinical decision making

2.5.2.1 Causality

A physician uses his/her clinical reasoning to explore the cause of a patient's presenting complaint (what they said was wrong with them). The patient's presenting complaint is the effect of cause/causes. Hume (1772: 14) believed that 'every effect is a distinct event from its cause. The concept (a priori) of the effect has to be random and cannot be discovered in the cause'. If we look at a patient with the presenting complaint of chest pain, chest pain cannot be the cause.

[7] Tort law deals with situations where a person's behaviour has unfairly caused someone else to suffer loss or harm. A tort is not necessarily an illegal act but causes harm and therefore the law allows anyone who is harmed to recover their loss (Williams 1982: 1)

Our concept of chest pain is someone with a pain in their chest. Our first thoughts tend to think of someone having a heart attack; therefore our causal inference is a heart problem. However, Hume taught that causation cannot even be demonstrated from the relationship observed. On logical grounds, no number of observations permits causal inference. No matter how many times A and B occur together, mere co-occurrence cannot reveal whether A causes B, although we do know that A is always prior in time.

With reference to Hume's view I suggest that in relation to medical diagnosis, the cause of the patient's illness/disease has to be in close proximity in space and time to the patient's presenting complaint. The cause must be prior to the patient's presenting complaint and there must be a constant combination between the cause and its effect on the patient.

Kant thought that space and time were necessary prerequisites for thought, actions and events and he argued that time and space are experienced subjectively. He stated:

> As soon as I perceive or anticipate that there is in this sequence a relation to the preceding state, from which the representation follows in accordance with a rule, I represent something as an occurrence, or as something that happens, i.e. I cognize (*become aware of*) an object that I must place in time in a determinate position which, after the preceding state, cannot be otherwise assigned to it (Kant 1781: 198, original emphasis).

Riegelman proposes that causes can be categorised into three types. These are necessary, sufficient and contributory :

Necessary causes:

If *x* is a necessary cause of *y*, then the presence of *y* necessarily implies the presence of *x*. The presence of *x*, however, does not imply that *y* will occur.

Sufficient causes:

If *x* is a sufficient cause of *y*, then the presence of *x* necessarily implies the presence of *y*. However, another cause *z* may alternatively cause *y*. Thus the presence of *y* does not imply the presence of *x*.

Contributory causes:

A cause may be classified as a "contributory cause," if the presumed cause precedes the effect, and altering the cause alters the effect. It does not require that all those subjects which possess the contributory cause experience the effect. It does not require that all those subjects which are free of the contributory cause be free of the effect. In other words, a contributory cause may be neither necessary nor sufficient but it must be contributory (Riegelman 1979: 177-9)

My interpretation of these three types of causes is given below. I have related them to medical conditions.

An example of a necessary cause:

If low blood pressure (X) is a necessary cause of collapse (Y), then the presence of collapse necessarily implies the presence of low blood pressure. The presence of low pressure (X), however, does not imply that collapse (Y*)* will occur.

An example of sufficient cause:

If a myocardial infarction[8] (X) is a sufficient cause of chest pain (Y), then the presence of a myocardial infarction (X) sufficiently implies the presence of chest pain(Y). However, another cause such as a chest infection (Z) may cause chest pain. Therefore the presence of chest pain(Y) does not imply the presence of a myocardial infarction (X).

My scenario example of contributory causes:

A patient is admitted with an allergy. The contributory cause was a reaction to a neighbour's cat getting into her/his house. Removing the patient from the exposure to the cat reduced the effect of the allergy. Not all people suffer from the same cat allergy but can suffer other allergies.

Due to my clinical experience, I was aware that my scenarios are subject to different interpretation. For example, there may have been other causes to pursue. In the case of necessary cause, the question I would have to ask is what caused the low blood pressure in the first place? If there was a blood haemorrhage that caused the blood pressure to drop which caused the collapse. In the case of contributory cause, was it the cat or an allergic reaction to something else.

Hage and Meeker (1988: 198) propose that causality is not deterministic, and is not solely necessary and sufficient. They see 'a causal process linking two events as occurring in a network in which there are other links, with multiple pathways and with a set of conditions or contingencies that may alter the processes'. In the application of causality, the philosopher, Mackie (1965)

[8] Myocardial infarction – heart attack.

proposed a modification of the ‘necessary and sufficient’ reasoning. Hage and Meeker (1988: 7) report this as follows:

> If we analyse an example of a particular causal situation, such as determining the cause of a fire in a house, we run into some difficulties using strict necessary and sufficient logic. Suppose, he [Mackie] says the fire is said to have been caused by an electrical short circuit. A short circuit is not a necessary condition, since many other conditions could create a fire. Neither is it sufficient, since this particular short circuit would not have caused the fire had there not been combustible material nearby, the absence of a sprinkler, and so on. Mackie calls this an INUS condition (Insufficient but Necessary part of a complex of Unnecessary but Sufficient).

The causal model for this fire incident would be; the causal system in the world we want to represent such as (Fire, sparks, oxygen, energy source etc); the probability distribution, P (Fire) = low. P (Fire/sparks, oxygen, energy source) = high. P (Fire/ sparks, no oxygen, energy source) = 0. Finally, a graph would be used which would show the causal relations in the causal system.

Although, universally accepted that event A must precede event B in time, philosophers during the 20th Century began to believe that A can cause B without every instance of A being followed by an instance of B, therefore a notion of indeterminate causality emerged. This indeterminate causality, led to the understanding that cause cannot be identified with any certainty, that we can only identify probable causes in the social world, and that there are two interpretations of probability, objective and subjective. This view is supported by Gillies (2002: 3) who suggests:

> ... the notion of indeterminate causality leads naturally to a network representation, as indeterminate causes can have several effects, and many effects several causes, therefore there is no way of showing these relationships by a simple linear sequence. The arrows in the network demonstrate the asymmetry of causality.

The process of forming a medical diagnosis requires the physician to identify probable causes of a patient's presenting complaint. To undertake this task they have to use clinical reasoning and clinical decision making. Hage and Meeker (1988) and (Williams 2009) suggest that the concept of social causality should be regarded as probabilistic and not a deterministic one, taking into account the countervailing forces or causal networks that work against the occurrence of an event as well as those that work for it. Popper amongst others, viewed causality as a special case of probability, where 1 is the certainty of an outcome and 0 is its impossibility (Popper 1990; Miller 1994; Suppes 1957). Popper believed that probabilities are properties of situations themselves and not just an expression of our apparent knowledge of them. Therefore, if we took a single event, and tried to identify its cause, we could not make any claims about the probability of its cause without knowing the probabilities of the events within the situation in which it occurs. This view is reported by Williams (2009: 6) who suggests:

> ... causes are the actualisation of single events and consequently have a probability of 1 and that in the physical world certain events can have an a priori probability of 1, i.e. they must come about. Equally, some physical states have a priori value of 0 that they cannot occur. He gives the example of unaided human flight. He argues that such zeros and ones in the social world may appear to take on *a priori* character but this usually rests on earlier social contingency.

The world is an uncertain place, and as such, every situation is unique with its own causal properties. We cannot assume that one situation would be like another or that one person would react in the same way as another. Cartwright (2002: 10) argues that 'in the case of human beings - who are not after all electrons - we cannot rule out the possibility of intrinsic variability'. This means that between the 0 and 1 there is a range of different probabilities. Popper

(1990: 20) suggests that ‘causation is just a special case of propensity: the case of propensity equal to 1. Thus, to take a simple example, a large dose of cyanide will definitely cause death. A suitably small dose of cyanide might only give rise to a propensity of 0.6 of dying’.

The complex, contingent and generative character of cause is emphasised by critical realists. They feel that by understanding causation in this way, they are able to make knowledge claims about the world as it is (Byrne 2011: 78). I understand this to mean that cause can be seen as multifaceted, may happen but not certain to happen and can produce an effect. This is relevant to understanding the medical diagnostic process where physicians are trying to identify the cause of a patient’s presenting complaint to enable them to form a medical diagnosis. This is complex as there are many causal conditions which may influence the physician’s clinical decision. These are illustrated in the following diagram:

Diagram 2.3 - causal conditions.

Identifying the cause of patient's presenting complaint.

The Physician The Patient .

Causal conditions:

Medical knowledge and experience.

Mindset.

Bias.

Interpretation of clinical evidence

Causal conditions:

Inherent factors: age, sex etc.

Lifestyle.

Personal preferences.

Presentation of clinical evidence

↘ ↙

Causal conditions:

Environment

Space

Time

↓

Clinical reasoning and causal attribution.

↓

Formation of a medical impression/working diagnosis.

Each causal condition has so many facets to their character, that they are difficult to describe. Byrne (2002: 7) suggests:

> Complex systems have emergent properties – they have properties that cannot be explained in terms of the properties of their components.

Given that they display emergence, they can and do change in a non-linear way.

A couple of clinical examples of emergence could be: the ‘white coat syndrome’, where a patient’s blood pressure becomes elevated when entering a GP’s consulting room or where an asthmatic’s breathing can become irregular and laboured due to several factors which may be environmental, biological or psychological.

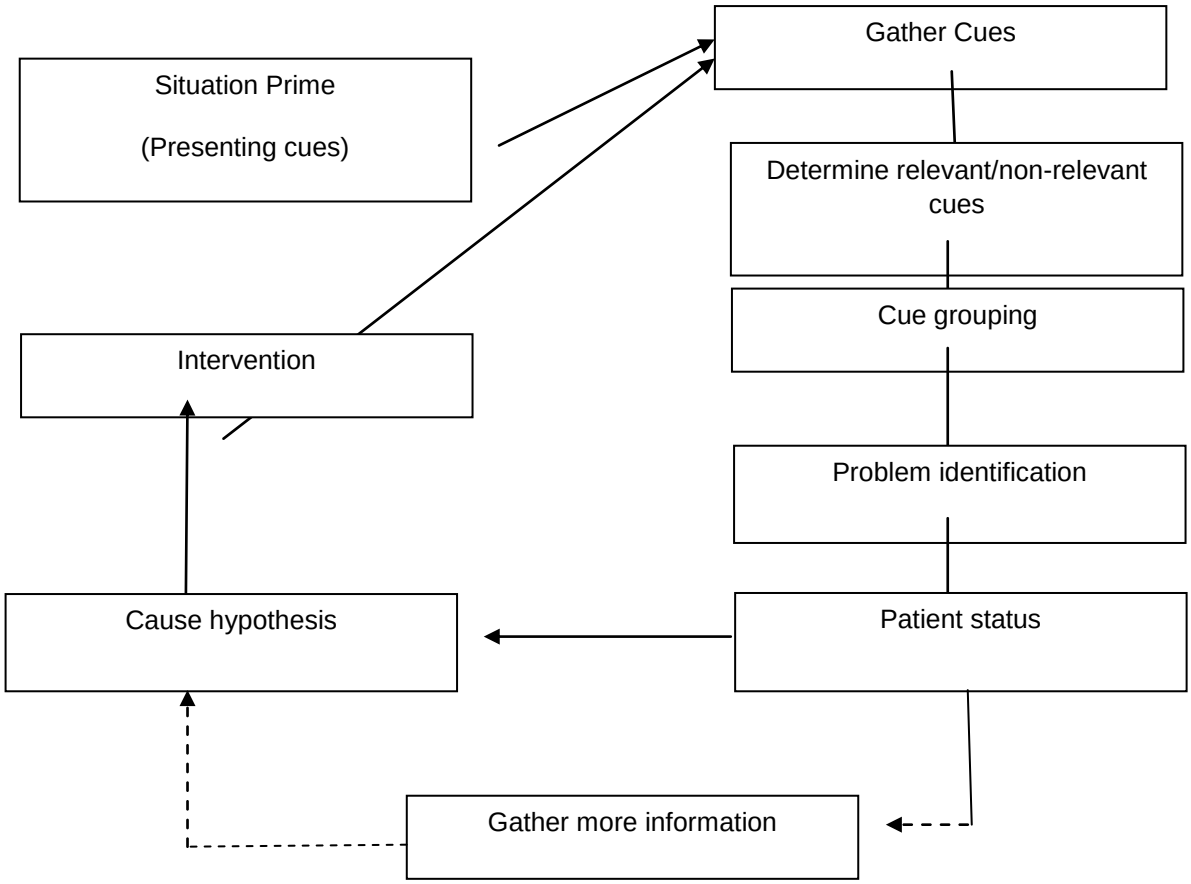
2.5.2.2 Clinical reasoning process

Clinical reasoning is a complicated part of the diagnostic process and at any stage in the process there can be problems. The information given by the patient may be inadequate or flawed, or the physician may have asked the wrong questions; the hypothesis that the physician sets may be wrong, he/she may have misinterpreted the data or assigned them to the wrong category; or the physician may fix on an hypothesis and rule out any further tests or information to clarify the diagnosis. The definition of clinical reasoning is given as ‘a thinking process directed towards enabling the clinician to take ‘wise’ action, meaning taking the best judged action in a specific context’ (Harris 1993 cited by Higgs and Jones 2000: 3).

Since the 1980s much discussion and research has been undertaken to explore the nature of clinical reasoning; Norman (2005: 418) reviewed the past history and current trends of research into clinical reasoning, and identified that there was ‘little evidence that reasoning could be characterized in terms of general process variables and that clinical reasoning expertise was not associated with a single basic representation but with multiple coordinated representations in memory, from causal mechanisms to prior examples’.

The clinical reasoning process model (Diagram 2.4) based loosely on the work of Radwin (1990) and Tichenor et al (1995) (cited by Higgs and Jones 2005: 175) is useful in showing the stages thought to be associated with the diagnostic reasoning process.

Diagram 2.4 - Clinical Reasoning Model



Each stage of the clinical reasoning process represents complex activities. The presentation of cues is how the patient's signs and symptoms are presented to the physician. However, this stage can be fraught with difficulty, as effective communication between the physician and the patient is crucial to gain the best information with which to inform the clinical decision making process (see Section 6). As Dowie and Elstein (1988: 201) observe, 'the information given to the physician is only as good as the patient's account, and this itself may be

limited due to the condition of the patient at the time of admission and other factors'. This view is supported by Barrows and Picknell (1991: 2) who suggest:

> The information available at the outset of a patient encounter is usually insufficient to arrive at any diagnostic conclusion. Ambiguities and conflicting or inadequate information are the rule in medicine. You can never be sure that you have really solved a patient problem, you can only be confident of approaching a solution.

The subsequent stages; gathering cues, determining relevant and non – relevant cues, cue grouping and problem identification, are also complicated. Taylor (2005: 3) observes that 'diagnosis is the first decision that a doctor has to make in the management of a new patient'.

Factors that enter into clinical decisions:

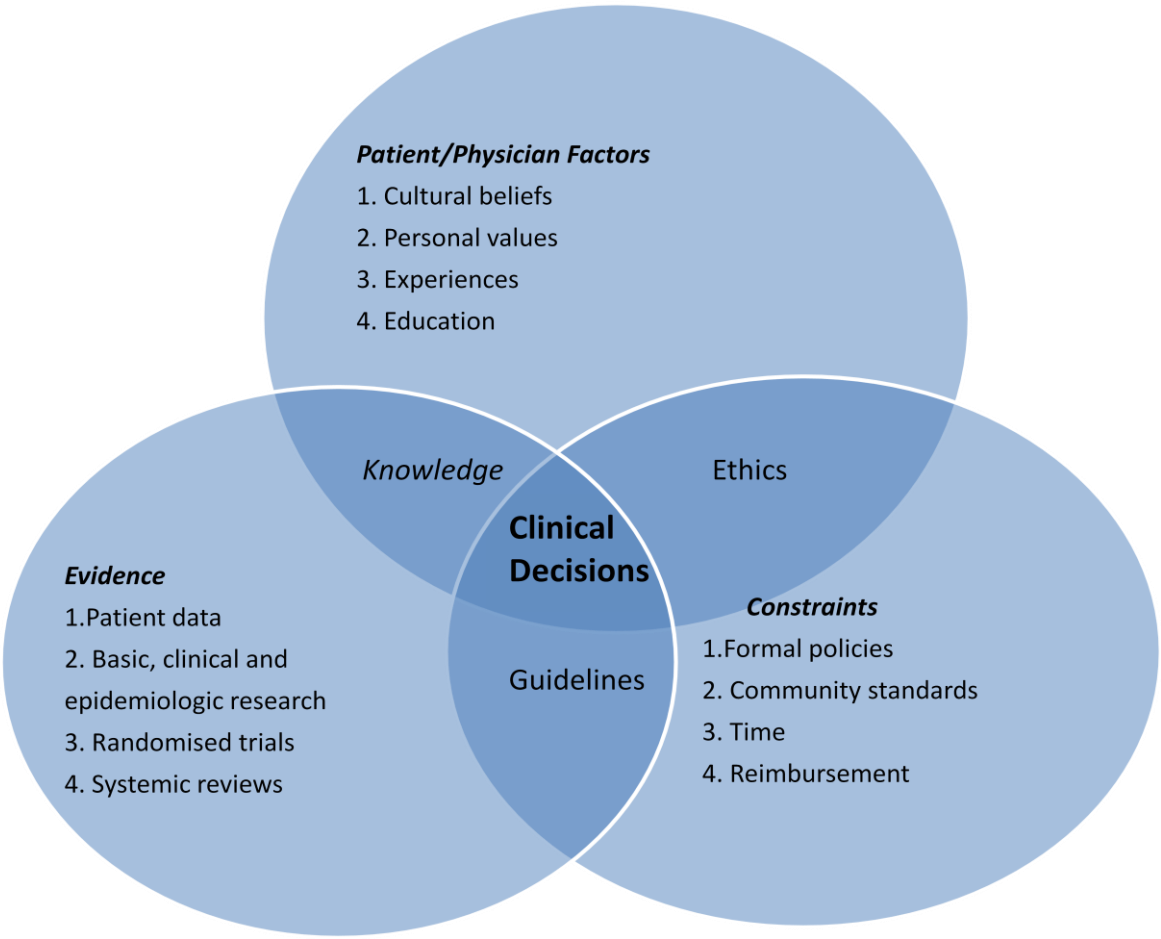


Diagram 2.5 – Factors in clinical decisions. Adapted from Mulrow, C.D. et al. Annals of Internal Medicine, 1997; 126: 389–391. (N.B. Reimbursement does not apply in England).

2.5.2.3 Thinking, knowing and understanding information

There is now an acceptance that clinical reasoning and clinical knowledge are interdependent, rather than being factors that can be learned separately (Higgs and Jones 2000). To develop an understanding of clinical reasoning and decision making, research into clinical reasoning has been closely linked to cognitive psychology. Croskerry and Norman (2008: S24) note that 'current work in cognitive science suggests that the brain utilizes two sub systems for thinking, knowing and information processing; System 1 and System 2'. This is shown in the table below:

Characteristics of System 1 and System 2 approaches in decision making		
Characteristics	**System 1**	**System 2**
Cognitive style	Heuristic	Systematic
Operation	Associative	Rule based
Processing	Parallel	Serial
Cognitive awareness	Low	High
Conscious control	Low	High
Automaticity	High	Low
Rate	Fast	Slow
Reliability	Low	High
Errors	Normative distribution	Few but significant
Effort	Low	High
Predictive power	Low	High
Emotional valence	High	Low
Detail on judgment process	Low	High
Scientific rigor	Low	High
Context	High	Low

Table 2.6 – Approaches in clinical decision making. Adapted from Concise Encyclopaedia of Information Processing in Systems and Organizations, and the Robots' Rebellion: Finding Meaning in the Age of Darwin, cited by Croskerry and Norman,2008: S25.

It is suggested by Kassier (2010: 1118) suggests that 'humans often jump to conclusions, using intuitive heuristics and reflexive rules of thumb. Such conclusions often turn out to be correct, but when they miss the mark in medicine such a miss can be costly in terms of a patient's welfare'.

2.5.2.4 Use of memory in clinical reasoning

Social scientists suggest that there are 'three forms of memory involved in clinical reasoning. These are sensory, working (or short term) and long term memory (Ashcraft 1989; Baddeley 1990 cited by Higgs and Jones 2000: 167):

Using sensory memory effectively for clinical reasoning depends upon having working knowledge of:

- Significant cues associated with clinical phenomena within one's discipline-specific domain. These include not only the clear obvious stimuli, but also those that are subtle or ambiguous as well as those that are extraneous or should not be present.

- The discipline-specific language used to transform stimuli into mental information. This is the initial identification or interpretation of sensory stimuli. In the cognitive science literature, this assignment of descriptors to incoming stimuli is called encoding.

Working memory is the next element of the memory system used in clinical reasoning. It is likened to a processing centre taking in information from both the sensory and long term memory. It is suggested that working memory has major limitations and constraints including:

- Restricted duration (i.e. 15-20 seconds unless mental rehearsal takes place).
- A capacity of only five to nine chunks[9] of information at any time (Miller 1956).
- Easy loss of information through distraction (Higgs and Jones 2000: 169).

The last element of the memory system is the long term memory. This is likened to a library of knowledge and experience. The clinician consults his/her long term memory to identify and interpret information in his/her working memory. There are two major divisions of long term memory, these are 'semantic memory, containing knowledge and episodic memory, containing experiences' (Higgs and Jones 2000: 170).

[9] A chunk is a cluster made up of one or more units of related information that has become a familiar pattern and thus can be recognised as a single item (Larkin et al 1980)

Schmidt et al (1990) suggest that it is these two divisions of long term memory that differentiates the novice and the expert, when they are making their clinical decisions. They propose that the novice physician primarily use theoretical knowledge from semantic memory and then gradually add their clinical knowledge. Whereas, they suggest that the expert physician tends to rely on his/her episodic memory when making a clinical judgement.

2.5.2.5 Clinical reasoning approaches

Various views have emerged regarding the clinical reasoning approaches employed by physicians, leading to diagnosis; some of these are shown in the following table:

Authors	**Approaches**
Elstein et al (1978)	Hypothetico – deductive
Barrows and Feltovich (1987)	Pattern Recognition or inductive reasoning
Kassirer (1989)	Probabilistic, causal and deterministic
Bursztajn et al (1990)	Diagnostic paradigms
Dowie andElstein (1988)	Bayesian approach
Schmidt et al (1990)	Knowledge reasoning integration
Higgs and Jones (1995)	Process of integrating knowledge, cognition and meta cognition
Patel and Groen (1986)	Forward and backward reasoning

Table 2.7 – Views on clinical reasoning.

2.5.2.6 The hypothetic – deductive reasoning approach

In this process, the physician makes assumptions of what s/he thinks caused the patient's medical condition, a differential diagnosis, and then rules in or rules out each condition through his/her taking of the patient's history, examination of the patient and if required tests and investigations. Elstein et al (1978) suggest that:

> ... diagnostic problems are solved by a process of generating a limited number of hypothesis or problem formulations early in the workup and using them to guide subsequent data collection. Each hypothesis can be used to predict what additional findings ought to be present if it were true and then the workup is a guided search for these findings (cited by Higgs and Jones 2000: 96).

The hypothetic deductive method can be divided into four stages:

1. Identify the hypothesis to be tested.
2. Generate predications from the hypothesis.
3. Use experiments to check whether predictions are correct.
4. If the predictions are correct, then the hypothesis is *confirmed*. If not, then the hypothesis is *disconfirmed* (Lau and Chan 2010: *philosophy.hku.hk/think/sci*).

Relating these stages to the medical diagnosis process, the hypothetic deductive would look like this:

1. Identify the patient's presenting complaint.

2. Identify a probable cause of the patient's presenting complaint and form a differential diagnosis – what could the probable diagnosis/es be, given the patients signs and symptoms?

3. Use observations, tests and investigations (if necessary) to rule in or rule out a probable diagnosis.

4. If tests, observations and investigations are indicative of an illness or disease then the differential diagnosis is ruled in or ruled out and an impression/working diagnosis is made.

A suggestion by Lau and Chan (2010) is that confirming the predictions of a theory increases the probability that a theory is correct. But in itself this does not prove conclusively that the theory is correct' (ibid). In the medical diagnostic situation, I interpret this to mean that the physician may rule in or rule out his/her differential diagnosis based on the evidence before him/her, but this does not mean the diagnoses made is necessarily the right one, but that it is the most probable one.

2.5.2.7 Diagnostic paradigms

Bursztajn et al (1990) suggests that there are two diagnostic model paradigms present in medicine, these are the mechanistic paradigm and the probabilistic paradigm. The model of mechanistic paradigm is evident in the diagnosis of some illnesses/conditions; especially in emergency situations. For example, a patient is admitted to the emergency department having sustained an injury to their head following a fall, the patient is presenting with the classic signs and symptoms of a subdural haematoma[10] such as a deterioration in the level of consciousness, a progressive deterioration of his/her nerve reflexes and the

[10] Subdural haematoma – clot of blood on the brain.

pupil of his/her right eye is dilated. The physician acts quickly with this objective data, makes a diagnosis and arranges treatment to remove the blood clot from between the patient's brain and skull.

With the probabilistic paradigm, the physician accepts that disease/illness can have a range of possible but uncertain causes and that it may be reasonable to deviate from the rigid two step model of diagnosing a cause and then treating it. 'The Probabilistic Paradigm accepts a degree of uncertainty as an inherent part of reality'. (Bursztajn et al 1990: xxv).

When making his/her medical diagnosis, the physician has to be aware that all patients are individual, therefore it cannot be assumed that one situation would be like another or that one person would react in the same way as another. This uncertainty in medicine and the need for the use of probabilistic clinical reasoning when forming a medical diagnosis is summed up well in the following :

> For as long as there is individual variability in human biology; in the specific manifestations of any given disease; in the social setting in which the disease occurs; in the psychological response to disease; and, in turn, the feedback effect of that response on the disease and the patient's perception of it — as long as all those differentiating and problematic factors exist, as they will forever, there can be no certainty in medicine, and medicine will remain an art rather than a science (Nuland 2008: 6).

2.5.2.8 Bayesian approach

To endeavour to take a scientific approach to the issue of identifying cause, a 'causal model framework' based on the mathematical theory for representing probability called Bayesian networks' was proposed. This causal model was first

spelled out in detail in a book published in 1993 by Spirtes, Glymour and Scheines. The theory was developed by Pearl in the 1980s.

The causal model has three parts, it represents, the causal system in the world, the probability distribution and a graph that depicts causal relations in the system. The Bayesian interpretation of probability is according to which probabilities encode degrees of belief about events in the world and data is used to strengthen or weaken those degrees of belief (Swinburne 2002).

There has been some debate over the interpretation of Bayesian networks, Pearl (1985) intended them to be use subjectively, whereas Lauritzen and Spiegelhalter (1988) suggest that in some cases the interpretation can also be given objectively. Gillies (2002) expresses some concern over this suggestion:

> The use of subjective probabilities, is connected with a Bayesian methodology in which evidence is used to update degrees of belief through the process of Bayesian conditionalisation[11]. The use of objective probabilities is similarly connected with a Popper (or Popper-Fisher) methodology similar to that of classical statistics. Here the emphasis is on the testing of any assumption made by means of classical statistical tests (Gillies 2002: 8).

The use of Bayesian methods interprets probability as a state of knowledge; assigned to a hypothesis, which is a proposed explanation for an observable event. Bayesian inference uses a numerical estimate of the degree of belief in a hypothesis before evidence has been observed and calculates a numerical estimate of the degree of belief in the hypothesis after evidence has been observed (this process is repeated when additional evidence is obtained).

[11] Conditionalisation advocates belief updating via probabilities conditional upon the available evidence. It identifies posterior probability (the probability function after incorporating the evidence with conditional probability (the prior probability function conditional upon the evidence).

Bayes' theorem (Joyce 2008) adjusts the probabilities given new evidence in the following way:

$$P(H\backslash E) = \frac{P(E\backslash H)P(H)}{P(E)}$$

P – Probability

H – Hypothesis

E – Evidence

The Bayesian approach to probabilistic reasoning can be used to illustrate the probabilistic paradigm. By undertaking a clinical assessment of a patient the physician is trying to establish the cause of their illness/disease. S/he needs to identify the patient's signs and symptoms and look at the probability of different diseases that could cause these signs and symptoms. This task is complex, but can be demonstrated by an analytical solution using a simple example of Bayes' formula.

$$P(\text{disease/findings}) = \frac{P(\text{findings/disease}) \times P(\text{disease})}{P(\text{findings})}$$

An explanation of the formula is as follows:

P (disease/findings) - During the clinical assessment of the patient the physician examines the patient and takes account of their signs and symptoms, s/he then tries to assess the probability that a patient has a disease.

P (findings/disease) - The physician using his training and knowledge of the signs and symptoms that occur with different diseases this gives

some information about the numerator of the equation, but not enough to know the probability of those signs and symptoms being responsible for the disease. For that information s/he needs to know the percentage of patients who exhibit the same signs and symptoms in relation to the disease and the frequency.

P (disease) – The physician needs to find out the underlying frequency of the particular disease in the population.

P (findings) – The physician has to consider that the signs and symptoms exhibited by the patient could have been caused by any of the probable diseases.

The problem with the Bayesian approach appears to be that in complicated cases the physician can still be left with lots of diseases to consider, therefore the formula is compromised if their information is poor about any one of the component probabilities of the formula. For example, a particular problem is the difficulty in determining priors in Bayesian reasoning. In medicine, the physician forms a prior belief that a patient has a certain disease/condition, however, this prior probability may be incorrect and this affects the whole formula. The Bayesian approach is discussed further in Chapters 5 and 6 with reference to responses from physicians during their one to one interviews and the informal use of a Bayesian approach in the clinical setting during the medical diagnostic process.

2.5.2.9 Probabilistic, causal and deterministic reasoning

Kassier (1989: 893-900) considered three reasoning strategies, these were probabilistic, causal and deterministic He suggests that probabilistic clinical reasoning is based on the linkage of association of clinical variables. These are often described in statistical terms, for example, the association of evidence-based medicine or statistics, linked to a patient's signs and symptoms. Goldthorpe (2001) suggests that three different understandings of causation have been shaped by contributions from statisticians. These he labels: causation as robust dependence (it is acknowledged that although correlation or association does not imply causation; causation must in some way imply association) causation as consequential manipulation (for example a randomised control trial) and causation as a generative process (where a claim for a causal link has to be supported by empirical evidence). I suggest that this view can be likened to the Bayesian approach as discussed in 5.4.3.

In causal reasoning a physiologic model is built up and the patient's findings are assessed for consistency and completeness against the model; this helps in verification of diagnostic assumption. A simple example of this could be; a chest infection causing a fever. In this case, a chest x-ray showing consolidation and a blood test showing a raised white cell count could be indicative and supportive of the physician's differential diagnosis a chest infection.

In the case of deterministic clinical reasoning, Kassier suggests that the physician is seeking a conclusion produced by a set of rules; an example for this could be the result of an abnormal blood test which proves conclusively that the patient has a disorder. For instance, a high Troponin blood test level confirming that the patient has had a heart attack. For this result to determine

the physician's clinical reasoning, he/she needs to have the knowledge of the normal results within haematology and biochemistry.

Kassier (2010: 1118-1123) suggests that:

> Reasoning based on causality is another approach to diagnosis that is based not on probabilistic considerations but on pathophysiologic concepts. Causal reasoning involves forming inferences based on major cause-and-effect relations between clinical variables or events. Because such reasoning often relies on the pathophysiologic aspects of individual disease states, its application is far narrower diagnostically than the other strategies. Nonetheless, causal reasoning is a powerful analytic tool to explain discrepancies in certain diagnoses. Such reasoning may also be useful in unravelling disease polymorphisms, namely, instances in which a patient's clinical manifestations fail to match precisely with the textbook description of a disease state.

2.5.2.10 Pattern recognition

In the pattern recognition approach to clinical reasoning, the physician associates the clinical signs and symptoms displayed by a current patient with previously seen and remembered clinical problems of another patient and adopts a previously-successful management strategy. 'Categorization of a new case can be based either on retrieval of and matching to specific instances (instance-based or exemplar – based recognition) or on a more abstract prototype. In instance-based recognition, a new instance is classified by resemblance to memory of a past case (Brooks et al 1991; Medin and Schaffer 1978; Norman et al 1992; Schmidt et al 1990 cited by Higgs and Jones, 2000:97).

Coderre et al (2009: 678) suggest that 'diagnostic performance is conditional upon underlying knowledge: to diagnose one must retrieve clinical and/or biomedical knowledge from long-term memory and then apply this to a new

clinical problem'. The following suggests how a physician uses pattern recognition in a clinical setting:

> When a practitioner makes sense of a situation he perceives to be unique, he *sees* it *as* something already present in his repertoire. To see *this* site as *that* one is not to subsume the first under a familiar category or rule. It is, rather, to see the unfamiliar, unique situation as both similar to and different from the familiar one, without at first being able to say similar or different with respect to what. The familiar situation functions as a precedent, or a metaphor, or... an exemplar for the unfamiliar one (Schön 1983: 138).

2.5.2.11 Knowledge reasoning integration

Schmidt et al (1990: 611-21) proposed a cognitive structure of medical expertise based on the accumulation of clinically relevant knowledge about disease signs and symptoms referred to as illness scripts. In this model, the development of elaborate knowledge networks (Bordage 1994) evolves through a process of biomedical knowledge acquisition, practical clinical experience, and an integration of both theoretical and experiential knowledge.

Higgs and Jones (2000: 11) propose a model that is argued to be more patient/client centred. It is based on a revised version of their three core elements of clinical reasoning, which were; knowledge, cognition and metacognition and defines clinical reasoning as a 'process in which the clinician interacting with significant others (client, caregivers, health care team members), structures meaning, goals and health management strategies based on clinical data, client choices and professional judgement and knowledge'. This overview of clinical reasoning is interesting, but the environment where the clinical decisions are being made would play a significant part in its use. For

example, in a primary care setting (GP services) there is more time for the involvement of caregivers and the multidisciplinary team in the clinical decision making process. This is also true in mental health services and some other specialities. Whereas, in an acute secondary care setting such as an acute medical ward or an emergency department, the clinical decision may be required to be made quickly and the clinical reasoning that takes place is therefore more medically focused.

Client centred clinical reasoning

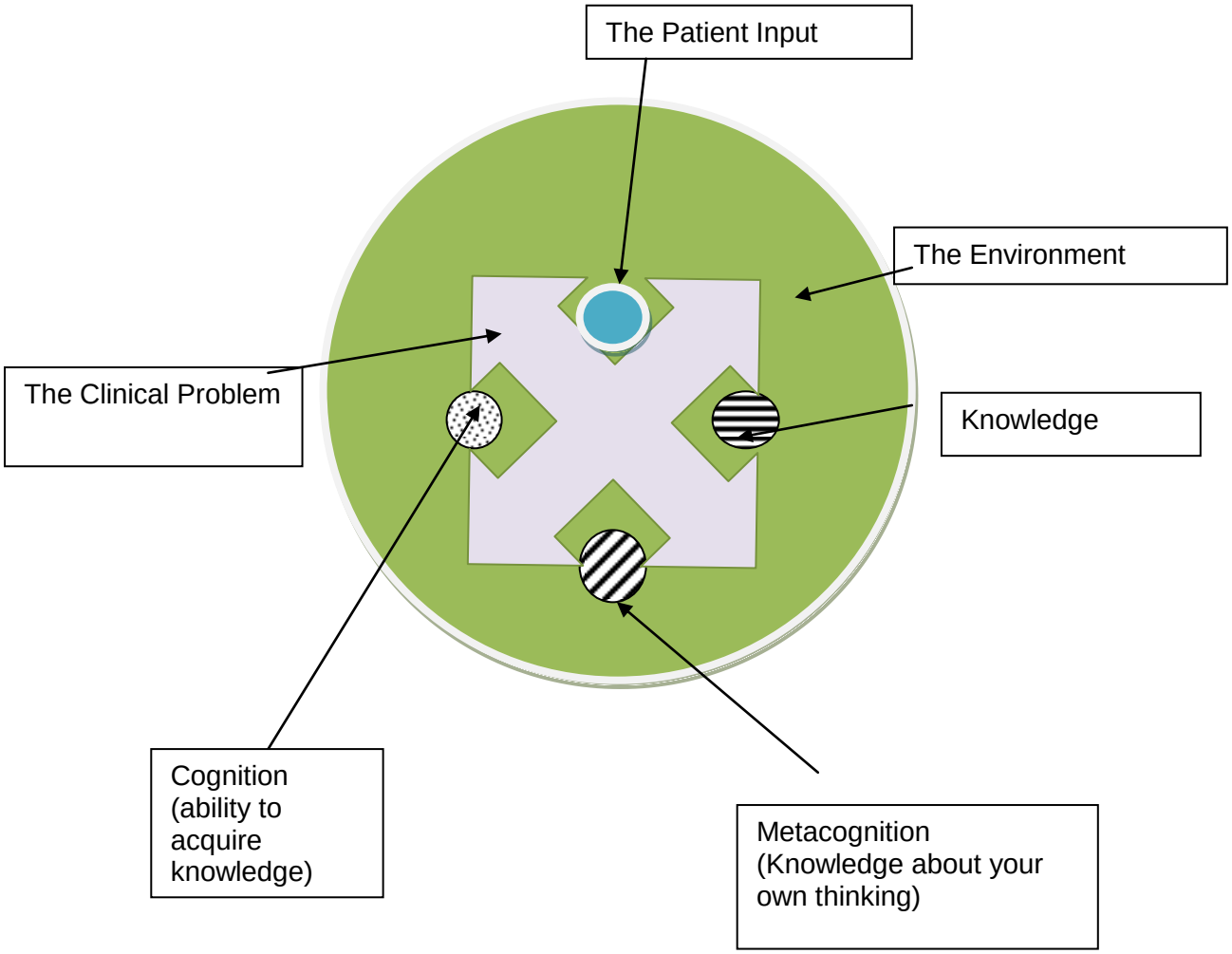


Diagram 2.6 - Client/patient centred clinical reasoning, I have adapted the diagram from Higgs and Jones (2000: 11) it still represents their model but is drawn differently.

2.5.2.12 Backward and forward reasoning

Backward reasoning appears to be very similar to the hypothetic-deductive approach. In this approach, a reinterpretation of data takes place or new data is quoted to test a hypothesis. I also argue that forward reasoning appears to be similar to pattern recognition using a sound knowledge base. Patel and Groen (1986: 91) argue that 'forward reasoning is more likely to occur in familiar cases with experienced clinicians and backward reasoning with inexperienced clinicians or in atypical or difficult cases'. However, the value of this research was questionable, as physicians were shown written case-notes in a set time frame. When the notes were removed, the physician was then asked to recall the information and make a diagnosis. Other researchers such as Klein, Calderwood and MacGregor 1989, Huber, 1997 believed 'that in examining real world decisions a more naturalistic approach needs to be taken'(Cuthbert et al 1999: 3).

2.5.2.14 Recent clinical reasoning research views

Recent research into clinical reasoning has taken place. Yudkowsky et al (2009: 729) suggests that a hypothesis-driven physical examination provided medical students with a 'thoughtful, deliberate approach to learning and assessing physical examination skills in a valid and reliable manner'. Aberegg et al (2008) discuss how novice clinical problem solvers need to build their skills in recognizing patterns within patient data (illness scripts) which suggest the main diagnostic possibilities and that until the students acquire these skills they could take a similar approach to how patients make their own diagnosis; a search-inference framework.

In a recent qualitative study, Bonilauri Ferreira et al (2010) evaluated the transcriptions of sixteen physicians' reasoning during appointments with patients. They identified four main themes, these were: simple and robust heuristics, extensive use of social environment rationality, attempts to prove diagnostic and therapeutic hypothesis while refuting potential contradictions using positive test strategy and reaching saturation point.

Another study looked at the use of explicit and implicit thresholds in diagnostic medicine. The researchers argued that the explicit threshold of practical guidelines and decision analyses are used infrequently and that most medical decisions are made at the bedside using implicit thresholds. These thresholds are the 'threshold to test' and the 'threshold to treat'. They state; 'No matter how they are defined, the goal of thresholds is to convert the continuous spectrum of medical uncertainty into a manageable discrete model of classifications and actions' (Warner et al 2010: 556).

2.5.2.15 Biomedical knowledge

It is clear from the clinical reasoning approaches mentioned here, that a great deal of knowledge is required to be accessed and utilised by the physician during the diagnostic process. Schmidt et al, 1990 suggest that the 'linking of the basic biomedical sciences with clinical and epidemiological information is crucial, as is the capacity to organise these data into coherent representations of disease processes' (cited by Higgs and Jones 2005: 184).

Two studies undertaken by Boshuzen and Schmidt (1992: 153) explored the role of biomedical knowledge in the diagnosis of clinical cases. The findings generally support 'a three stage model of expertise development in medicine consisting of acquisition of biomedical knowledge, practical experience and

integration of theoretical and experiential knowledge resulting in knowledge encapsulation', their finding also suggested a tacit role of biomedical knowledge in expert clinical reasoning.

The elements of the biomedical model can be seen below:

- Dualistic – The Cartesian divide of mind and body is at the centre of how diseases are understood and treated.
- Mechanistic – 'Man the machine' points to a causal chain that is governed by complex universal rules. These causes and rules are open to 'discovery' classification and understanding by scientific methods.
- Reductionist – Biological explanations of disease are sought out from the observed behaviours of the body and the particles associated with the condition.
- Empirical – Knowledge is generated by observation and can be confirmed through a process of experimentation. This entails the objective role of the observer and the assumption that the material being observed is only subject to natural forces.
- Interventionist – Medical knowledge can be applied to 'repair' damage or sick biological systems. This frequently involves the direct use of instruments to make changes to the body (Hardy 1998:9).

2.5.2.16 Pathophysiological knowledge

Pathophysiology is defined as the study of the biologic and physical manifestations of disease as they correlate with the underlying abnormalities and physiologic disturbances. It explains the processes within the body that

result in the signs and symptoms of a disease. It is not thought of as an independent course at all medical schools/universities (Kovac 2007). However, all medical curricula recognise the necessity and importance of understanding the aetiology and pathogenesis of disease for medical practice:

> Scientific advancements in biomedical research have been generating copious amounts of verifiable data on human physiological and pathophysiological phenomena. New conceptual frameworks have been created, and sophisticated methodologies and powerful information computing systems have come close to the everyday practice of medicine. There is an exponential growth of potentially relevant and applicable knowledge (Kovac 2007: 387).

The clinical link to pathophysiology is shown in Table 2.6, which highlights how pathophysiological knowledge can guide patient care (Brashers 2002). The example shown relates to ischemic heart disease:

Pathophysiology *What is going on in the disease process that influences how he or she should be managed?*	→	**Clinical Link** *What should you do now that you understand the underlying pathophysiology*
The spectrum of ischemic heart disease includes all of the stages in the pathogenesis of atherosclerosis and has the same risk factors, with superimposed threat of thrombosis	→	Prevention of coronary artery disease rests on the reduction of risk factors for atherosclerosis plus antiplatelet drugs and /or anticoagulant drugs
Ischemic myocardium produces lactic acid that stimulates the sympathetic nervous system	→	Elderly patients with diabetes may not have pain with myocardial ischemia. The examiner must have a high index of suspicion in patients with risk factors
Myocardial ischemia can be transient or prolonged with actual necrosis of heart muscle; myocyte death results in the release of cardiac enzymes CPK-MB and troponin1.	→	Measurement of serum cardiac enzymes differentiates angina or non-cardiac pain from true MI(myocardial infarction, heart attack)but the serum levels of these markers may take hours to rise, thus delaying the definite diagnosis
Cardiac ischemia often results in decreased LV contractibility with increased LVEDV and pulmonary venous congestion	→	Dyspnoea(shortness of breath) and transient or persistent CHF(Congestive Cardiac Failure) and pulmonary oedema are common features of MI and carry a negative prognosis.
Transient ischemia with exercise or stress when there is a fixed but partial coronary obstruction such that demand exceeds supply for coronary perfusion.	→	Stable angina has predictable precipitating factors and is relieved with rest; life style modification can reduce angina symptoms.
MI occurs when a coronary atherosclerotic plaque ruptures and a thrombus forms	→	In patients without contraindications, the rapid administration of antiplatelet or thrombolytic drugs can restore perfusion, limit infarct size, and reduce mortality
Unstable angina occurs when a coronary atherosclerotic plaque id beginning to crack and platelets begin sticking to the lesion.	→	Unstable angina is essentially one step from MI in its pathophysiology and must be treated aggressively to avoid MI
Some of the effects of myocardial ischemia include remodeling and stunning; these have deleterious effects on LV function.	→	Treatment of ischemic disease with ACE inhibitors and beta blockers may prevent future Congestive Heart Failure.

Table 2.8 - Clinical link to pathophysiology(Adapted from Brashers, 2002: 43)

2.6 Expert and novice physicians

There has been a great deal of discussion regarding the difference between the experienced physician and the novice physician regarding clinical reasoning. An original assumption had been made that experienced physicians held an expertise in clinical reasoning skills, Norman (2006: 2251) observes:

> ... acquisition of general strategies or heuristics-clinical problem solving skills-possessed by experts striven for by students.

However, this appeared to be flawed, as the expert was only found to be as good as the content of knowledge he/she possessed. Elstein et al (2002) labelled the phenomenon 'content specificity'. Studies mentioned by Cuthbert et al (1999: 2) such as; Patel et al (1994) have distinguished the differences between novices and experts:

> ...*novices* (individuals who have only everyday knowledge of a domain or the pre-requisite knowledge assumed by the domain, i.e. medical students), *intermediates* (individuals who are above the beginner level but below the sub-expert level, for example, medical residents),*sub-experts* (individuals with generic knowledge but inadequate specialised knowledge of the domain, for example, cardiology experts solving problems in the area of endocrinology) and *experts* (an individual with specialised knowledge of the domain, for example, cardiology experts solving cardiology problems.

The capabilities for the application of clinical reasoning skills is determined by the level of knowledge of the learner is suggested by Harasym et al (2008: 341-55).They argue that the levels are as follows:

Reduced: has little knowledge; uses intuition and guessing strategy for problem solving. Novice learners often rely on intuition, with rapid responses to situations by pattern recognition or initial impression. Intuition can be influenced

by emotional state. Nevertheless, intuition is useful for generating an initial list of hypotheses.

Dispersed: has limited and superficial, but not deep, knowledge. Uses hypothetical deductive reasoning strategy for problem solving. Hypotheses are formulated by reasoning backward from the data. Intermediate learners.

Elaborated causal: has more extensive deep knowledge including probabilistic and cause-effect knowledge. Uses hypothetical deductive reasoning for problem solving. Hypotheses are formulated by reasoning backward from the data. They are more likely to make a correct diagnosis compared to learners with dispersed (limited) knowledge.

Hierarchical: has knowledge of expert schemes with organized differential diagnoses based upon common attributes in defined categories. Reasoning is applied in a forward fashion using the data in an expert-derived scheme or algorithm. There is 5-fold increase in arriving at the correct diagnosis over use of hypothetico-deductive reasoning.

Scripted: applies pattern recognition from long-term memory of numerous past examples. This is mostly an unconscious, non-analytic process used by experts. They then perform further investigations that are primarily confirmatory. There is a high degree of accuracy of getting the correct diagnosis, a 10-fold increase over use of hypothetico-deductive reasoning. However, the pure use of pattern recognition by novices and intermediate learners is not recommended.

In a recent study conducted by Groves et al (2003), it was found that experts made more errors in data gathering and data interpretation than novices, but were more accurate overall because they generated better hypotheses, they

suggested that the expert may only have one hypothesis and will work towards gathering data to confirm a tentative diagnosis; this strategy is called ‘forward thinking’’. Norman et al (2000: 435) explain: ‘the distinction between forward and backward reasoning is derived from the detailed structure of the propositional networks, where forward reasoning was associated with conditional relations in the form ‘if fever, then infection’ and backward reasoning from causal rules ‘if infection, then fever’.

It is argued that experts have ‘reduced the steps in clinical reasoning to an unconscious process (Boshuizen et al 2007, Groves et al 2003, Kassier 2010)

- Identification of information that is clinically relevant to a diagnosis
- Proper interpretation of the information
- Development of hypotheses with a coherent explanation of the findings
- Refinement of hypotheses with targeted data collection
- Establishment of a working diagnosis

Carter and Berlin (2003) when teaching clinical teachers how to use the clinical consultation as a learning opportunity, differentiates between the novice and expert history taker. They suggest that an hypothesis is formed by the novice and the expert within thirty seconds of the patient encounter (Table 2.9).

Novice	Expert
External list of Qs	Internalised list of Qs
Unfocussed, inappropriate	Focused and selective
Slow, lots of closed questions	Responds to patient, allows patient to lead
Over - controlling	Picks up cues and clues
Easily lost	Uses silence and open questions
Inaccurate, unlikely hypotheses	More accurate hypotheses

Table 2.9 – Comparison of novice and expert history taking. Adapted from Carter and Berlin (2003)

2.7 Concluding comments

Scientific advancements in medicine have been seen to shift the balance between medicine as an art, to medicine being regarded as an applied science. The discourse surrounding the debate on whether medicine is an art or a science or both remains ongoing. We have seen a thread of this debate running through many of the sections in this chapter; in particular; evidence-based medicine, medical education, tacit knowledge and clinical reasoning. In medicine, art and science appear to be interdependent. The physician requires the scientific knowledge on which to base his/her clinical practice while using his/her 'art' of clinical judgement. This interdependence is acknowledged in medical education and training. Medical education remains strongly embedded in the scientific knowledge of biomedicine and pathophysiology. While, medical training is now more focused on patient centred care; the art of being caring and compassionate while understanding patients' individual needs. The individuality of patients and their physicians are factors inherent in the uncertainty found in medicine. This has been recognised within medical education and advancements have been made to try to deal with the management of this uncertainty. Reaching a medical diagnosis has been conceptualised as a

process of reasoning about uncertainty. The development of evidence-based medicine was an important step in providing systematic information to aid and improve the physician's clinical decision making. Nonetheless, evidence-based medicine does not fully address uncertainty. This is owing to the fact that not all patients conform to the 'normal' pattern of illness/disease.

The forming of medical diagnosis is a complicated process which takes place in a world of uncertainty. The physician has to contribute a cause for a patient's illness/disease based on information gathered throughout a consultation with the patient. In 2.5.2.1, we have seen philosophical views expressed regarding causality and these views form a basis on which to explore an explanation of how a physician attributes the cause of a patient's illness/disease when forming a medical diagnosis. It appears that causality should be viewed as probabilistic rather than deterministic, as each event that takes place has causal factors that work for and against it. This fits with the uncertainty in medicine.

Each patient is individual and this can make a difference to the way that they present their symptoms to the physician. It is therefore important for a physician to listen to his/her patient, as they tell their story (personal history). This provides valuable information, which can only be gained through the use of effective communication skills during the physician/patient interaction. Other information is gathered through the physical examination of the patient and where necessary, tests and investigations. All this information has to be processed through the physician's clinical reasoning. This clinical reasoning is influenced by the physician's own mindset, values and beliefs.

In 2.5.2.5, we have seen that many authors have written about a number of different clinical reasoning approaches, such as; hypothetic-deductive reasoning; pattern recognition; probabilistic reasoning and diagnostic paradigms etc. I suggest that even though the models/approaches used in clinical reasoning may vary, the emphasis is on problem solving. The problem that the physician is trying to solve is to find out the probable cause of the patients illness/disease. It has been acknowledged that errors in clinical reasoning have accounted for many diagnostic errors. There has been a great deal of discussion regarding the differences between the expert physician and the novice physician regarding the way in which they use clinical reasoning. Some views expressed suggest that the expert have more expertise in clinical reasoning. This is an interesting concept and one which is explored further within this study when searching for a causal account of how physicians diagnose illness/and disease in a medical setting.

Next, in Chapter 3, I explain the methodology and mixed methods I used to gather my data. I provide some details regarding my physician respondents and their patients and the clinical setting in which the research took place. I explain the rationale for the mixed methods I used when analysing and interpreting my data.

Chapter 3 – Methodology and Method

3.1 Introduction

In this chapter I discuss my methodological approach and the methods I used in my research. I set out a background for the choice of research methods; my experience when using these methods and how I explored and interpreted/analysed the collected data. I chose a case-based quasi-longitudinal study using mixed research methods. I felt that this would provide both an explanatory framework and a deep understanding of context and process. The qualitative methods I used were semi-structured interviews with the physicians and an overt observation of their clinical assessments of their patients, leading to diagnosis. The aim of the observation was to observe the physicians' behaviour, as a stream of actions and events, as they naturally unfolded. This naturalistic observation informed my comparative study between the different clinical areas that existed within the Emergency Department; minor injury/ailments, major injury and complex medical conditions. My quantitative method was a secondary data analysis of the medical case-notes of the consenting patients involved in the study; the data collection took place concurrently with the overt observation, within the emergency department.

3.2 Background

My goal was to explore physicians' clinical reasoning and causal attribution in medical diagnosis. To capture this naturally occurring data, I decided to focus on the physicians' medical assessment of patients admitted to an emergency department. My rationale for choosing an emergency department was that I felt

that this area would provide high patient activity levels, patients presenting with diverse illnesses/diseases, patients from mixed age groups, and a range of physicians with varied levels of expertise. The referral pattern into an ED was usually either through the patient's own volition or through emergency ambulance services. I felt that this situation would provide me with the opportunity to witness the medical diagnostic process from its conception.

This decision had not been taken lightly. I had to weigh up the pros and cons of using other clinical areas, such as; primary care (GP services), mental health, acute medicine, acute surgery or other specialities. I felt that in primary care, the patient's diagnosis would involve one grade of physician; a general practitioner (GP). I felt that many of the appointments that I would have observed would have involved follow-up appointments. This meant that the GP would have previously diagnosed the patient and would be using the appointment to reassess their treatment plan or to refer them to another health professional.

I could have chosen the Medical Assessment Unit (MAU), but I felt that most of the patients would have been admitted via their own GP, locum services or the emergency department. This meant that the patients would usually be accompanied by a GP referral letter or medical notes, where a provisional diagnosis or differential diagnosis had already been inferred. I felt that this scenario would have been the same for the Surgical Assessment Unit (SAU).

In the speciality wards, such as oncology, neurology and cardiology and so on, the majority of patients would already have a diagnosis. I also ruled out mental health owing to the fact that this speciality takes a more multidisciplinary approach to diagnosis. The diagnosis is made over a longer period of time,

owing for the need for the patients have assessments made regarding their behaviour and mental state. The labelling of patients too soon can be detrimental to them. For example; there is a negative public perception of people diagnosed with schizophrenia. This is due to the unjust publicity in the media linking schizophrenics to violence and crime (Goulden et al 2011).

My methodological reasoning led me to choose a mixed method approach. I felt that I needed to capture the interaction that took place between the physician and the patient during the medical encounter. I decided that this would be best achieved using qualitative overt observation. By taping some of the interactions, I felt that I would later be able to show a descriptive narrative of the medical encounter. However, I realised that although this qualitative approach would provide some insight into the way in which physicians gathered information from the patient, it would not provide information about other aspects of the medical diagnostic process, such as; observations, physical examination, investigations and the physicians impression/working diagnosis. I decided that the only way in which to gain a full picture of the whole medical diagnostic process would be to use a quantitative approach using the secondary data analysis of the subsequent medical notes made by the physician. Lastly, I wanted to gage the views of the physicians regarding the what, how and why of the medical diagnostic process. I felt that this would be best achieved using a qualitative semi-structured interview. My intention was to analyse my data later using mixed analytical approaches, so that I had narratives and quantifiable data with which to compare and contrast my findings with the literature previously mentioned in Chapter 2 and other similar studies. Drawing on the strengths of both a qualitative and quantitative approaches, can help form a stronger conclusion (Yin, 2006), can be especially powerful in illuminating policy

solutions and directions for social action (Sosulski and Lawrence, 2008) and can provide pragmatic advantages when exploring complex research questions (Driscoll et al, 2007).

Table 3.1 shows how my research objectives mapped onto the research questions and the mixed research methods used. The mixed method analysis used is described in 3.8.

Objective	Research Question	Research Methods Used
1) To explore the clinical assessment process undertaken by physicians when looking for a cause/s of a patient's presenting disease/illness.	What kind of reasoning do physicians use when undertaking a clinical assessment and diagnosing individual patients?	**Qualitative:** One to one interviews with physicians. *To gage the views of the physicians regarding the individual clinical reasoning techniques they use when diagnosing their patients.*
		Qualitative: Overt observation of clinical assessment process. *To tape conversations, recording the dialogue between the physician and the patient when gaining the patient's history.*
		Quantitative: Analysis of subsequent medical case notes. *To see what observations, examinations and investigations were recorded by the physician in the medical notes. To note the physician's differential diagnosis and final impression/working diagnosis.*
2) To explore the challenges physicians face in blending clinical reasoning with evidence-based medicine when diagnosing individual patients	What challenges do physicians face in blending clinical reasoning with evidence-based medicine?	**Qualitative:** One to one interviews with physicians: *To ask the physicians their view on how the blend their clinical reasoning with evidence-based medicine in the clinical environment.*
		Qualitative: Overt observation: *To observe the physicians use of evidence-based medicine in the clinical environment.*

Objective	Research Question	Research Methods Used
3) To consider any social environmental factors which may influence the individual physician's reasoning skills (e.g. time constraints, availability of on-line information and peer pressure.)	Do any social environmental factors influence the individual physicians clinical reasoning skills?	**Qualitative:** One to one interviews with physicians: *To gather the physicians' individual views on any social environmental factors that influence their reasoning skills.*
		Qualitative: Overt observation: *To observe how the physicians worked in the clinical environment and to understand any factors that may impact on their reasoning skills*.
4) To provide an explanation of the physicians' clinical reasoning and causal attribution process leading to them forming a medical diagnosis.	Are there any causal conditions that may have influenced the physicians clinical reasoning?	**Quantitative:** Analysis of medical case-notes. *To look for any patterns of causal conditions relating to patients' presenting complaints.*
		Qualitative: Overt observation: *To observe any causal conditions during the medical encounter*.

Table 3.1 - Methods mapped to research objectives and research questions.

3.3 Gaining access to the research site

As previously mentioned, I decided to undertake my research in an Emergency Department in a large acute hospital within a NHS organisation. My clinical background helped me to identify the gatekeeper who could authorise my access to the NHS. In the first instance, I contacted the hospital's research manager to discuss my draft research protocol. She was supportive of my research project and after some discussion, recommended that I should contact

the lead medical consultant situated in the Emergency Department to discuss the proposed research with him.

I met the lead medical consultant and he seemed very interested in my proposed research project. As a mature student with a NHS clinical and managerial background, I realised that I could be seen as both an 'insider' and an 'outsider'; an 'insider' owing to my NHS background[12] and an 'outsider'; owing to the fact, that I was now retired from the NHS and attached to a University (Letherby, 2003; Bartunek and Louis,1996). This is addressed later in 3.7. The lead consultant felt that my experience would be beneficial and we discussed how to take my research forward. There were a couple of conditions attached to his support, these were; co- authorship on some papers and participation in research certificates for the physicians who agreed to consent to take part in the study, so that they could build their own research portfolios. My next step was to involve the consultant and the research manager in the development of my research protocol, particularly, the design of the physicians' questionnaires and the patient and physician consent forms. This proved to be advantageous and later helped me to gain my ethical approval from the ethics committee and a research passport from the hospital to enable me to commence the fieldwork part of my research study.

3.4 Ethics

The main focus of my research study was the physician, not the patient, as my study was concerned with observing a physician as s/he examined a patient

[12] NHS background. Qualified registered nurse practicing for twenty years, prior to moving into senior management for a further 18 years.

when admitted to hospital and how the physician made their initial diagnosis. My main ethical issues concerned with the study were consent and confidentiality. I designed my research protocol, to ensure that the consent procedure was clear and that I had a comprehensive inclusion and exclusion criteria, withdrawal process and complaints procedure.

Maintaining confidentiality was a key factor in my research design. I stated that all data would be handled / stored in a safe environment and would be anonymised, to protect the identity of any physician respondent and their patients. Somekh and Lewin (2005: 57) suggest 'confidentiality is a principle that allows people not only to talk in confidence, but also to refuse to allow publication of any material that they think might harm them in any way'.

Following my IRAS (Integrated Research Application System) submission to the Ethics Committee, I was asked to attend a meeting. The meeting with the committee went well and they were very helpful. The amendments suggested were in relation to my exclusion criteria for the patient consenting participants, which the committee wanted me to expand. This meant that I had to agree that the patients to be excluded from my research study would be; patients with a learning disability; patients with a recognised mental health problem; paediatrics; patients not wishing to participate in the study; unconscious patients; patients who could not understand the English Language[13]; and I had to agree that I would be guided by the vulnerability[14] of the individual patient. This tight criterion did have an impact on my research during my fieldwork, which is addressed in 3.7.2.

[13] The lead consultant felt that although there was access to an interpreter in the hospital, my research study was too complicated to translate in the time frame required for clinical assessments within the emergency department.

[14] The term vulnerable generally is applied to individuals who are unable to give informed consent or who are susceptible to coercion (Ruof, WHO 2002).

Other minor amendments to my protocol, suggested by the committee, were concerned with reducing the amount of information on the patient's information sheet and amending the patients and physicians' consent forms to include that a tape recorder would be used during the physicians interviews and some of the physician /patient overt observations.

3.5 Location of the research study

My research study took place in the Emergency Department (ED) situated in a large acute hospital.

3.5.1 The physical layout of the department was very significant to its operational procedures, it comprised of:

- Reception and waiting areas*
- 4 resuscitation bays*
- 17 majors cubicles
- 7 minors cubicles +2 triage cubicles
- A dedicated paediatric area*
- 2 walk-in theatres and a plaster room*
- A 10 bedded clinical decision unit*

Relatives room*

Staff offices

Staff Rest Room

** These areas were not included in my study due to my strict inclusion and exclusion criteria and the focus of my research.*

The department was laid out into different clinical areas (Diagram 3.1). The minors' area dealt with patients who had had minor incidents/accidents, such as; patients who had suffered fractures/sprains to their limbs or cuts and bruises, or patients complaining of obscure rashes etc. The major area dealt with patients who had had chest pain, falls, collapse, shortness of breath, abdominal pain and other medical emergencies.

Those able to move unaided entered the ED via the main reception, where they were clerked in, before being asked to wait in the waiting room. If someone appeared quite ill, they were escorted directly into a clinical area, and a member of the clinical team was notified.

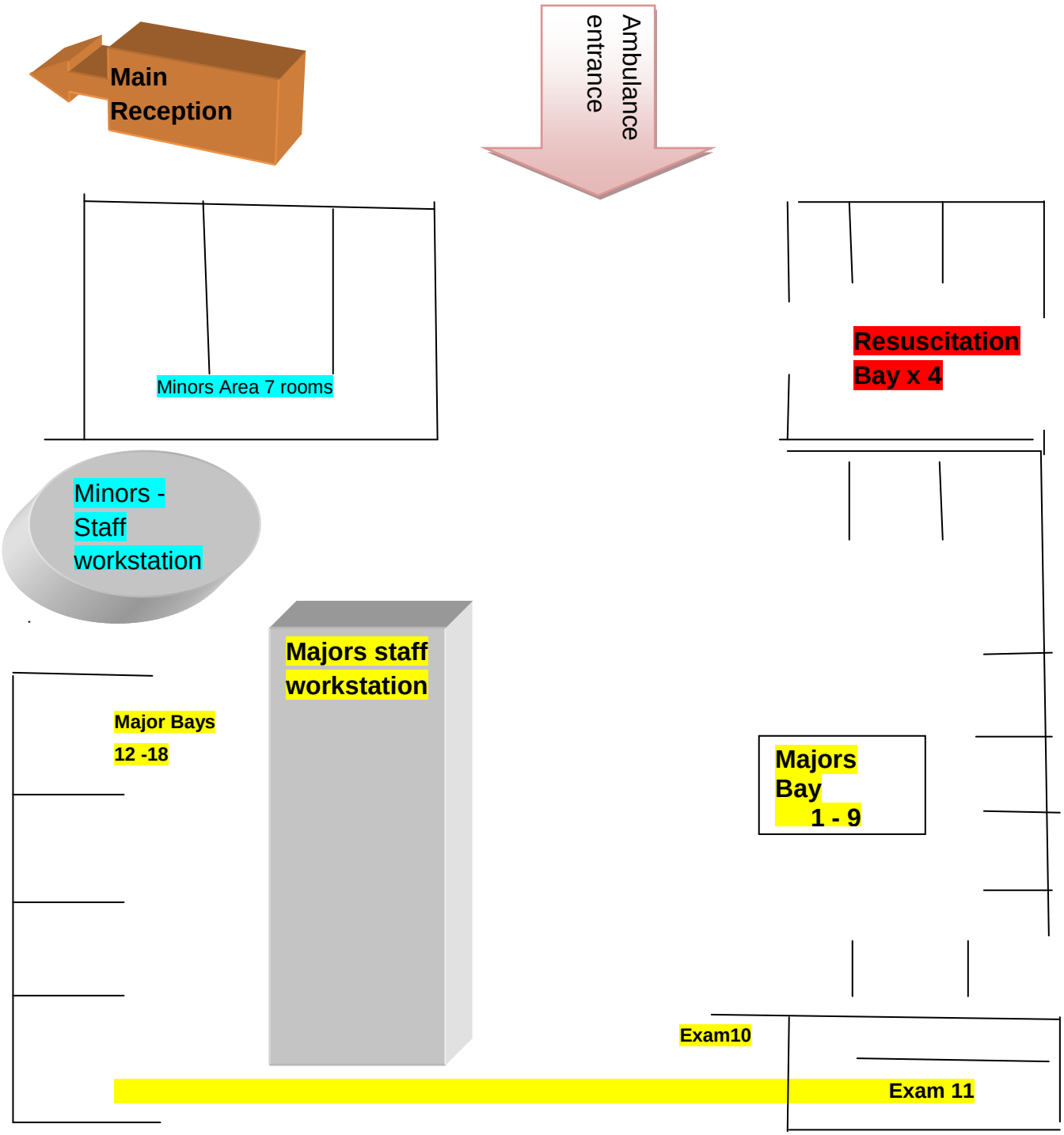
The ambulance admissions entered via a main entrance, critical patients were taken straight into the resuscitation room (usually the ambulance staff had contacted the ED prior to the patient's admission), while other patients came into the majors' corridor, where the ambulance staff were greeted by a nurse who received a verbal handover regarding the patient. The ambulance information sheet was photocopied by one of the ambulance staff and a copy was given to the nurse in charge. The ambulance crew also kept a copy of this information sheet for their records. The senior nurse on duty triaged the patients and they were coded on the computer system according to their medical needs. Computers were strategically placed within the department, the screens showed where the patients were located (which bay or room) what their initial presenting complaint was, their age, sex and the time they came into the department and how long they had been in for. These computers were used regularly by the physicians and other clinical staff. A colour coded system was used to mark the length of time that each individual patient was in the department, the colour

changed every hour and once the colour had changed to red, it indicated that the patient was at risk of breaching the 4 hour wait initiative [15]. The computers were also used to flag up alert warnings to staff, such as; a patient who was known to be aggressive to female staff or was known to be violent. The physician also used the computers to record any tests/investigations that were carried out, as if they were not recorded on the computer, the department did not receive any payment for them.

There was a pattern to the arrivals in the ED, adults tended to arrive during the day, usually peaking in the mornings, especially on Mondays and weekends. There was a steady flow of major cases during the day, with a steady trickle at night.

[15] The 4 hour wait – a government initiative which meant that patients could only remain for a maximum period of 4hours from the time they arrived in the ED to being discharged or transferred elsewhere within the hospital.

Diagram 3.1 – Physical Layout of the Emergency Department



3.5.2: The emergency department team

The staffing of the ED comprised of teams of nurses, nurse practitioners, physicians, health care assistants, porters, clerical and domestic support. The ED also had a close relationship with other departments and teams such as X-Ray, Medical Assessment Unit and other wards within the hospital. The ED received management support from the Emergency Services Directorate.

In the ED team the majority of the nursing staff and senior physicians were permanent staff, whereas junior physicians rotated through the department on 4-6 monthly turnover. Approximately 50 junior physicians pass through the ED per year. The junior physicians worked mainly in the minors and majors areas and stayed out of the resuscitation area, unless they were being trained by a more senior physician. The nurse practitioners stayed in the minors area.

The physicians worked very long shifts, eight hours and 12 hours. A majority of the time, they were allocated to an area for their full shift. This did sometimes change, if one area became busier than the other, or if there was a risk of patient breaching the four hour wait.

3.6 Consenting respondents and methods

3.6.1 My consenting respondents

In my original research protocol, I had chosen a sample size of 15 physicians to reflect the medical staffing levels[16] and 256 patients to manage a reasonable level of patient activity in the research area. However, the final study population

[16] ED medical staffing establishment totalled 39.

consisted of 26 consenting physicians respondents[17] (different grades) and 202 consenting patients in the Emergency Department. The increase in the physicians, who consented to take part, was due to their working practice (26 physicians took part in the overt observation, of which, 16 were interviewed). The decrease in patient numbers was due to the strict inclusion and exclusion criteria agreed with the ethics committee, as explained in Section 4 of this chapter.

It was very important for me to recruit a number of physicians who were at different stages in their careers; this was due to the fact that the literature regarding clinical reasoning had placed a great deal of emphasis on the 'expert' clinician. So to test this theory, I wanted to undertake a comparison between the 'so – called' novice (junior physicians) and the 'so-called' expert (senior physicians). Table 3.2 demonstrates the final breakdown of my physician respondents by grade, these were:

[17] The different grades for the physicians were Medical Student (2), Foundation Year1,F1(4), Foundation Year 2, F2 (2), ST1 (5), ST4 (1),Staff Grades (2), Registrars (3), Clinical Fellow (1), Associate Specialist (1) and Consultants (4).

Grade	Number
Consultants	5
Clinical Fellow	1
Associate Specialist	1
Registrars	3
Staff Grade	2
ST1/SHO	5
ST4	1
F2	2
F1	4
Medical student	2

Table 3.2 –Physician respondents' grades. See Glossary for detail.

All doctors, in the NHS or private practice, must be registered with the GMC to undertake clinical practice in the UK. They also have to have a license to practice.

The length of time the individual physician respondent had been qualified ranged from six months to 22 years. Their medical training had been undertaken in medical schools in diverse locations; London, Bristol, Plymouth, Newcastle, Cardiff, Poland, South Africa, Abadan and Nottingham.

202 patients met my inclusion/exclusion criteria and had consented to take part in my research study. Sixty-percent of the patients were male and forty percent were female. Table 3.3 shows a breakdown of the consenting[18] patients' ages:

Age range in years	18 - 25	26 - 45	46 - 65	66 - 80	81+
Number of patients	22 (11%)	53 (26%)	59 (29%)	64 (32%)	4 (2%)

Table 3.3 – Age range of patients

3.6.2 Using mixed methods

3.6.2.1 Qualitative methods

I conducted face-to-face interviews with physicians, using some structured questions (see Table 3.5) and allowed a space for physician respondents to raise issues that they felt important. Oppenheim (2000:112) suggests that 'once the respondent has understood the intent of the questions, they can let their thoughts roam freely, unencumbered by a prepared set of replies'. The ED physicians received an information sheet, prior to my gaining their consent to take part in the study. This information sheet gave the title of my research topic, which was; 'how do physicians diagnose illness/disease in a medical setting? It also explained the purpose of the study. The design of my questionnaire followed months of background reading around my chosen research topic; the medical diagnostic process.

[18] All the patients involved in the study gave their written consent.

Table 3.4 shows the rationale I used for the design of my questionnaire:

	Questions	**Rationale for the question**
Q.1	What is your Grade? (i.e. F1, F2 etc).	It was important for me to know if the physician was a novice or an 'expert'. An original assumption had been made that experienced physicians held expertise in clinical reasoning skills (Norman, 2006).
Q.2	How many years have you been qualified as a physician?	As above.
Q.3	Where did you train as a physician?	I wanted to know if a difference in medical schools made any distinction to the way the physicians were trained to assess patients prior to making a diagnosis.
Q.4	Can you describe to me the process you undertake when you are diagnosis a patient following their admission to the ED?	This question allowed the physician to tell me in his/her own words, the diagnostic process they used.
Q.5	Why do you undertake this process?	This question was asked to establish if this was a formal process or did the physician vary the process, according to the patient they were assessing.
Q.6	How do you decide on which questions to ask the patient, when gaining their medical history?	Taking a patient's history is seen as the most important part of a physician /patient interaction. Therefore I wanted the physician to explain to me how they decided on the questions to ask to gain this important information.

Q.7	Does your interaction with the patient play a part in the clinical assessment of the patient?	Bates (1995) suggests that a physician's interaction with the patient required skills of facilitation, reflection, clarification, emphatic responses, confrontation and interpretation. Therefore, I felt that it would be interesting to see if the physician realised the importance of their interaction with the patient.
Q.8	Does any medical equipment/instrument influence your clinical decision making process?	Reiser (1978) suggests that developments in technology marginalised the role of the patient as an active participant in diagnosis. This question was intended to see how the physicians' viewed the use of technology in the diagnostic process.
Q.9	Does your professional judgement play any part in your clinical decision making process?	Fish and Coles (1998:15) argue ' there are increasing demands on professionals for accountability yet professional people feel unable to say what the precise basis is for those acts of professional practice that give professionalism its uniqueness – their professional judgements'.
Q.10	How does your professional judgement affect making a diagnosis?	As above.
Q.11	Could you give me your view on evidence-based medicine?	Friedland et al, (1998) suggests that there are three components to evidence-based medicine, these are; medical decision making techniques, accessing medical information and assessing the validity of medical

		information. The access to medical information presents major challenges for physicians, such as finding the relevant information and keeping up with the literature and then ensuring that the information is from a reliable source.
Q.12	How do you blend your clinical reasoning skills with evidence based medicine in the clinical setting?	Various views have emerged regarding the clinical reasoning techniques. Therefore, I asked this question to see how the physician described their individual techniques.
Q.13	In your view, what percentages of patients are given the right diagnosis?	Studies on adverse events in hospital patients support the argument that reasoning errors have accounted for many patients receiving an incorrect diagnosis and subsequent mis-management and treatment (Wilson et al, 1999).
Q.14	How do you know that the diagnosis you have made is the right one?	This question was asked to seek the physician's individual views on this subject.
Q.15	Are there any factors that affect the way in which you diagnose a patient?	A recent article written from within the medical profession, states that 'most errors in clinical reasoning are not due to incompetence or inadequate knowledge but to the frailty of human thinking under conditions of complexity, uncertainty, and pressure of time' (Scott, 2009:5).
Q.16	What is your understanding of Bayes' Theorem?	Dowie and Elstein (1988) observe that the Bayesian approach can be

		used by physicians to try and establish the cause of a patient's illness/disease.
Q.17	Have you any further comments you wish to add/discuss?	Key concerns of physicians that I missed.

Table 3.4 – Rationale for the design of the physicians' questionnaire.

The fact that I had some structure in the interview process helped me to maintain the focus on the research area, but also provided an opportunity for the information gathered from my physician respondents, to inform the direction of my research and provided a wider angled lens view (Fontana and Frey 1994).

The interviews were conducted in a quiet room within the ED, during the physician's coffee break. The average length of time for each interview was approximately 20 minutes. This meant that I experienced some problems due to the restricted time frame for each of my interviews with the physicians, causing me some concern, as mentioned later in 3.7.4. However, Opdenakker (2006) suggests that if there is no significant delay between the times the questions are asked and answered, the response is more spontaneous without an extended reflection. Sixteen physicians were interviewed. The one-to-one interviews were taped (with the permission of the physician respondents) and then transcribed.

I chose an overt observational approach for my research, as Cooper et al (2004) suggested, it has a valuable application for those conducting research within a working environment over a short time. My plan was to watch the routine medical assessment that a physician undertakes, leading to him/her

forming a medical diagnosis. I realised the disadvantage to the observation, was that my presence could influence this routine activity, as the physician or the patient could change their usual behaviour (discussed in 3.7.1). However, the advantage was that I could undertake this method quickly. As it happened, it turned out to be a successful approach, as I managed to observe 202 routine medical assessments. This meant that I witnessed the way in which the physician communicated with his/her individual patients; what questions s/he asked to establish a patient's medical history; how s/he examined the patient and what investigations/tests s/he ordered to inform their impression/working diagnosis. Thirty-five of these observations were digitally recorded. I did experience some problems, these are discussed in 3.7.4.

3.6.3 Quantitative method

I used a secondary case-based analysis. I undertook a simultaneous audit of the medical case-notes of the 202 consenting patients taking part in the observation. Have (2004: 98) argues that 'seeing documents, such as patient records, as the product of sets and series of activities of documentation, and then seeing documentation practices as part and parcel of the stream of ongoing situated organisational activities, has important analytical and methodological consequences'. The suggestion is that seeing an activity in practice and then seeing the recorded documentation of this activity, provides a fuller picture. To support his view, Have (2004) compared the previous research of Garfinkel and Bittner (1967) who had studied clinical records in isolation from the activity they were reporting, and the studies undertaken by Heath (1982) who studied the routine documentation of physician encounters in a primary care setting, and used a mixed method approach to examine how GPs'

recorded their consultations. My mixed method approach, was to analyse the medical notes which represented the physician/patient interaction during the medical assessment process, which I had observed. Acquiring the notes to audit was not an easy one, owing to the fact that I had to make sure, that as soon as the physician had written up his/her medical case-notes, following each of the individual observations I had witnessed, that I could take their notes quickly to one side and copy them verbatim into my small notebook, ensuring that all the information remained anonymous.

I was quite pleased that the majority of the physicians' handwriting was extremely clear and this made my task much easier. The speed with which this process took place was stressful for me, in some cases, especially if the patient was being discharged or transferring to another ward and if the patient was at risk of breaching the 4hour wait. (see 3.7.2.7.and 3.7.5).

3.7 Dilemmas in the field

3.7.1 The personal dilemma

During my long career within the NHS, I have used my inquisitive mind to delve into areas that have interested me. However, this was always linked to my employment and whatever role I occupied at the time. This research project was a totally new experience for me, as I had retired from the NHS and was now a research student.

Prior to starting my fieldwork, I had decided to give two briefings to the physicians working within the ED, mainly to introduce myself to them and to allow them to ask any questions. I was aware that some of the physicians may have viewed my research as threatening and judgmental, owing to the fact that

my study was exploring how they diagnosed their patients, therefore, I wanted to emphasise that this was not the case. One group received my briefing well, although one member of the group did say ‘I can see you are getting a PhD out of this, but what are we getting?’ which did throw me slightly. The second group were just in the process of receiving a training session and I felt that I was in the way, that they were all very busy, and that it was their lunch break. I also ‘felt my age’, and found myself imagining being one of them, looking at me and thinking ‘what on earth is this old woman doing here’. I relayed this thought back to one of my daughters afterwards, and said to her that they looked so young, she said ‘Don’t worry Mum; they are probably a lot younger than me, as I am nearly forty’. I don’t know if this helped me or not!

Prior to my fieldwork, I had been in clinical areas in an identifiable role, which related to the clinical work being undertaken, either giving hands on care to patients, as a qualified nurse, or in my management role, managing staff and a clinical setting. This was so different and I was out of my comfort zone. I knew from my own experience, the feeling of protectiveness to my own clinical area and the feeling I got when someone appeared with a clipboard, therefore I realised that it was also difficult for the staff, seeing someone new in their department, and I thought to myself; I bet they are wondering who this stranger is. Is this yet another audit?

To break the ice, I introduced myself to the nurse in charge and explained why I was in the department. I explained that I had been on a couple of visits prior to starting my fieldwork and had been introduced by the Lead Consultant to quite a few of the staff. The nurse in charge was very accommodating, so I soon felt able to relax a little. I then spent some time standing and observing the general

way in which the department ran. During the day, I introduced myself to others and explained why I was in the department. The social role I adopted was that of a clinician, who happened to be undertaking research. I did this by emphasising my clinical background (showing compassion and consideration for the patients and the staff) and playing down my management experience, which was strange really, because although I was a qualified nurse, I had not practiced for many years. I was aware of the 'them' and 'us' feeling that clinicians had for management and felt that as a clinician, I would be more accepted. Obviously, the fact that my research was exploring clinical practice, played a huge part in this, and had I been carrying out research into some management process, I would probably adopted my 'management role'. As Hammersley and Atkinson (1995:109) suggest:

> Decisions about the sort of role to adopt in a setting will depend on the purposes of the research and the nature of the setting. In any case, anticipation of the likely consequences of adopting different roles can rarely be more than speculative. Fortunately, shifts in role can often be made over the course of fieldwork.

Coffey (1999: 23) suggests that 'fieldwork involves the enactment of social roles and relationships, which places the self at the heart of the enterprise'. I found that as time went on during my fieldwork, I was more accepted. Yet, personally I never felt or wanted to be part of the team, as I wanted to remain slightly detached so that I could do my 'job' as a researcher. Nonetheless, I did have empathy for some of the situations that occurred within the department (see 7.6). Goetz and LeCompte (1984: 143) argue that 'the general principle across the board is that researchers should minimise their interactions with the

informants and focus attention unobtrusively on the stream of events'. I was aware that my presence as an observer would have some affect on the patient/physician interaction which I have taken into account during my study. Many authors have commented that as a researcher is a human being they play a role even in non-participant observation. (Atkinson and Hammersley, 1994; Bogdan and Biklen,1985).

My observation was overt and that meant that I was approached by different members of the team who were not involved in my study, but wanted to know what was going on. Although, I was initially seen as an 'outsider', as I was not 'part of the ED team', once they knew that I had been a qualified nurse; my status changed to that of a semi 'insider'. Being an 'outsider' and 'insider' at the same time had advantages and disadvantages. The advantage of being an 'outsider' was that I could just stand and observe what was going on without anyone thinking that I was being lazy, (although when the ED was extremely busy, I felt that I was). I could ask questions of people, which if I was working in the department, I would not have asked, such as; what did they think of the ED protocols or the four hour waiting time. The disadvantage was that at times, I felt that I was 'in the way', I could see some of the physicians who had previously consented to take part in my study, cringe, when I approached them to accompany them to see a patient, as if It was a hindrance that they could have done without. I did wonder if this meant that they felt that they had to 'perform' during their interaction with the patient because I was present and that this perception was causing them additional stress. I was also aware that the patient could have also been performing in the way s/he interacted with the physician. As Goffman (1959 :9) suggests:

> When we allow that the individual projects a definition of the situation when he appears before others, we must also see that the others, however passive their role may seem to be, will themselves effectively project a definition of the situation by virtue of their response to the individual and by virtue of any lines of action they initiate to him(sic).

However, the interactions between the physicians and the patients that I witnessed, did not feel 'false' as their body language; posture and attitude, were as I had experienced when seeing previous consultations throughout my career.

When I commenced my fieldwork the physicians were explaining very basic medical information to me, however, this stopped when they realised that I knew exactly what they were talking about. The commencement of my fieldwork coincided with some of the FY1 physicians commencing their first rotation, this was quite interesting, as at first they did not realise that I was not part of the team. Once I approached them regarding my study, they became aware of my role and the fact that I was undertaking research. Exploring how the physicians' diagnosed patients had a particular effect with these junior physicians, who at first became wary about their lack of experience, however, this changed as they settled in to their rotation in the department. There were times during the patient/physician's interaction that I felt that I knew the probable diagnosis before the physician made his/her diagnosis. This was quite a subconscious process on my part, as I found myself mentally retrieving information that I had not used for years.

A majority of the senior physicians treated me with respect. This could have been due to them wanting to get me 'on their side'. Fablo (1977) suggests that interpersonally oriented people tend to use soft and rational power tactics. Soft tactics are seen to be more 'indirect and interpersonal (e.g. collaboration,

socializing)' (Fablo and Peplau 1980: 618 - 628). However, I like to think that the senior physicians' respect was due in part to my professional background and how respectful I was to them, their staff and department. I did have one problem with being seen as an 'insider' and this was when one of the most senior members of staff, who knew me when I was working as a senior manager, said that he would appreciate my view on the way that the ED ran from a management perspective and would I be prepared to present a paper on it. I respectfully declined, on the basis that I was in the department as a researcher and that it would be wrong, as it would jeopardise the trust I had built up with the team.

3.7.2 Gaining consent

At first, gaining the consent of the physicians to take part in the study, did not seem to be an issue, as I had the advantage of having the lead consultant (my gatekeeper) near me which helped with the first couple of consent forms being signed. The physicians seemed to want to impress him by showing a willingness to take part in the study:

> Status relates to power in that it yields control over social values to others, namely, liking and respect. That is people generally want to be liked and respected by those who are relatively high in status. As such, high status individuals often have social power over others (Fiske and Berdahl 2007:682).

However, once I went solo, it was a different story and I got two refusals straightaway, which really 'panicked' me, as I had visions of not gaining any more physician respondents. Fortunately, I soon found that the longer I was in the department, the more people got to know me and seemed to be interested in taking part. I had at last got the message across that I was not there to judge

their practice, but to examine the process they took in undertaking their clinical assessment of the patients and their clinical decision making.

The ease with which I gained the patients' consent varied, depending on the physician I was observing. This was due to the way they introduced me to the patient and if they gave me the time necessary, to gain the patient's informed consent. In my research protocol, I had developed a process of obtaining the patient's consent, which was to let the patient read the information sheet and then to allow some time for the patient to ask me any questions, prior to them signing their consent form. This process was very difficult to achieve in reality, however, I was very conscious of my ethical duty to ensure that I adhered to this part of my research protocol.

When the consent process went well, I found myself feeling like a nurse again and enjoying an interaction with a patient and their relative. I could have a banter with some of the patients when gaining their consent, such as saying 'this is voluntary you know and you could tell me to get lost if you want' this seemed to lighten the situation. Some of them seemed to like the fact that I had retired, but was still doing something active. It has been suggested that when gaining consent, reducing social distance by adopting appropriate language and demeanour can prove useful (Bogdan and Taylor (1975) Fontana and Frey (1994) Hammersley and Atkinson (1983).

At other times, I had to admit to myself, that I found it a very stressful process and a hard slog. This was due to the time constraints and having to ensure that I kept to my strict inclusion and exclusion criteria. In some cases, I went through the consent process and gained the patients written consent, only to find out that when the physician started his/her questioning, that the patient had

a recognised mental health illness and was therefore excluded from my study. On these occasions I immediately stopped recording the patient/physician interaction. I then waited until the end of the interaction and explained to the patient that I would not be using their case as it did not meet my criteria. I did not tell the patient that it was due to them having a recognised mental illness as I felt this was unfair and that I was labelling them. The consent form was voided and I erased any notes I had made or recorded. Eventually, after completing 35 patient/physician taped observations, I decided that it would be appropriate, to stop recording the observation of the patient/physician interaction and to use the patient's notes instead. This meant that I could introduce myself to the patient and ask for a verbal consent to listen to the conversation between them and the physician, and not make any notes. Then, when the physician had finished assessing the patient, I could gain the patient's written consent to use their medical notes. I found this process to be much better from an ethical point of view, as although I had remained ethical before; in gaining consent to record the conversation between the physician and the patient, from a personal perspective I always felt that it was too pressurised for all concerned. I could now give the patient much more time to discuss their consent. This turned out to be a really good process and certainly avoided the inclusion of anyone who did not meet my inclusion/exclusion criteria. Wellington (2000: 3) suggests that 'ethical concerns should be at the forefront of any research project and should continue through to the write-up and dissemination stages'.

This decision to slightly change my approach was not taken lightly, and was made in conjunction with the fact that during my observations, when I was transcribing the taped interaction between the physician and the patient, and then transcribing the medical notes the physician had written, it became

apparent that they were virtually the same. It was very interesting and reassuring to see how much of the patient's own 'story' was relayed and reflected in the medical notes made by the physician following the consultation.

3.7.3 Physicians' Interviews

The scheduling for interviewing of the physicians was difficult. Unfortunately, I had to adapt my research protocol to suit the clinical area and working pressures of the physicians. This was due to the fact that I had been informed by the hospital management, prior to the commencement of my fieldwork that owing to the financial constraints imposed on the NHS; I was only allowed to interview physicians in their own time. Owing to the fact that the physicians worked really long shifts with an infrequent break, I decided to undertake the taped scoping interviews whenever it was practicable during the six month observation period. Fortunately, the questions worked extremely well and I was able to gather further clarity through my observations.

My own clinical background provided me with the knowledge and experience to understand the sensitivity required when interviewing or observing the physicians undertaking their roles, and I was aware of the pitfalls and advantages of being an 'insider researcher' (Letherby, 2003). The advantages for me, were that the physicians responded well to my questions and that they felt that I understood the pressures they faced in working in such a busy department within the NHS and the difficultly of some clinical situations, therefore were more open. Yet, I had to be careful not to interpret what they said, before they said it. I therefore ensured that I listened to their responses and only prompted them by saying 'can you elaborate on that' or 'what do you mean?' rather than saying 'oh, I know what you mean'.

3.7.4 Overt observation - collecting the data

As time went on during my fieldwork, I managed to recruit more physicians than I previously intended to. There was an element of necessity to do this, as I could turn up in the department on a day where none of my physician respondents were around or where my physician respondents were working in 'minors' and seeing children which was obviously excluded from my study. There were times, when I could be waiting three or four hours for a 'suitable' patient. I found these times really frustrating and I am ashamed to say, that I felt irritated, if the patient my physician respondent was seeing, turned out to have dementia or a recognised mental health history, thereby excluding them from my study. As the period of my fieldwork progressed, I felt that I was being ruled by having to get the numbers. It became a battle not a pleasure. As Letherby (2012:146) suggests 'research then is inevitably a power-laden, emotional, embodied experience'.

I experienced this frustration on several occasions, for instance, at the beginning of the day I could feel really happy that the day was going well, as a couple of my physician respondents were on duty, which meant that I would get more patients consented to take part in the study. However, suddenly the situation would change, owing to the fact that a patient in need of resuscitation, would arrive by ambulance in the ED and my two physician respondents would be pulled away…this was a double whammy, as the patient was not suitable/excluded from my study and the physicians would not have time to see patients who were. I felt guilty having these thoughts; it was out of character for me, as I became selfish rather than compassionate. Outwardly I was accepting

of the situation, remained professional and empathetic, but inwardly, I was really thinking of patients/physicians as respondents in a research study who could either aid or hinder my research process of collecting my data.

My days did vary according to who was on duty. Some of the physicians were happier and more accommodating than others, which was obviously much better in terms of data collection. I was not oblivious to the fact that they had their own internal pressures, not just their jobs, their personal lives and ambitions.

3.7.5 External pressures and staff morale

There were external pressures which had an impact on the department, and on the morale of my physician respondents. These were things like the upheaval in the department with the arrival of the new matron, who promptly announced that drinks were no longer allowed at the work-stations. This did not go down well with the physicians in particular. They already worked long shifts with infrequent coffee breaks and could work for hours without any refreshments, other than a quick cup of coffee at the work-station.

Bed pressures and the possibility of breaching the four hour wait was a concern that more often than not were outside of the physicians' control. It was usually due to a bed shortage elsewhere in the hospital causing a backlog in the transfer of patients out of the ED. The physicians got frustrated as they felt they had done all they could; the patient had been medically accessed and was awaiting transfer to a receiving ward. Bed shortages had a real impact on the ED. If there were beds in Clinical Decision Unit, Medical Assessment Unit or appropriate wards within the hospital then it all flowed well, if not, there was a tension. Extra cubicles had to be created; one cubicle being turned into two

cubicles with the use of screens. Patients waited longer on trolleys at the entrance with the ambulance staff. The whole department felt very busy. However, in the midst of this chaos the physicians' role did not appear compromised. I observed them still fulfilling their role and continuing with the routine of assessment and management of the patient as usual.

Even the laying of new flooring in the 24 hour department, did not change the way the physicians and nurses carried out their roles, as they continued with their routine, adapting to which bays were shut etc. This was quite remarkable really.

A negative effect on the physicians' morale concerned the way that they had to see the next patient on the computer screen, based on triage and the time the patient had already been in the emergency department. This made them noticeably frustrated, as it meant that they could end up seeing the same type of cases throughout a day. They felt that this had a negative impact on the experience they could gain during their rotation to the department.

3.8 Analysis/interpretation of data

The aim of my analysis/interpretation of data has been to use a case-based [19]approach to look at social process of medical diagnosis, and to see if particular causal conditions or combination of causal conditions were always present when the diagnoses was made. To achieve this aim, the data I collated through my mixed method approach required mixed methods of analysis/interpretation.

[19] Case-based – all the data used real characters of individual patient cases.

3.8.1 Brief overview of my analytical process and rationale:

a) To analyse/interpret the responses given to me by the individual physicians during their one to one interviews I used Excel and NVivo 8. I undertook definitive analytic procedures to produce taxonomies of common elements within the data, and narrative analytical procedures to produce explanatory stories regarding the social process of medical diagnosis (Polkinghorne, 1995).

b) To analyse/interpret the documentary evidence of the patients' medical notes, I used SPSS and QCA. My reasons for doing so, were that I had accumulated natural case-based data regarding the medical diagnostic process. I wanted to capture this data, so I created variables which were the characters of real cases (see Table 3.6). Once I had established my variables, I was able to explore my data by running frequencies and descriptive analysis from within the data. This enabled me to develop categories through cross tabulation. This cross tabulation was useful to identify groups of patients and to show descriptions and frequencies of associated variables. Initially, there were eleven groups; these were reduced to two groups (8.4). I could see a pattern emerging that showed that some of my variables appeared more frequently in one group, Group 1 than in the other group, Group 2. I was now familiar with my cases and the research literature, so I decided to change some of my categorical variables into binary variables (8.4) so that I could undertake further analysis using Qualitative Comparative Analysis (QCA). My logic for using this method was that 'QCA was conceived as an 'aid to [the] interpretive analysis' of cases' (Ragin 1987: 120) . By using QCA, I could

see each case as a combination of causal and outcome conditions and then compare these combinations with other cases. Ragin (1987) suggests that QCA can determine the number and character of the different causal models that exist. Schlosser et al (2008: 6) suggests 'each individual case is considered as a complex combination of properties, a specific "whole" that should not be lost or obscured in the course of the analysis – this is *holistic* perspective'.

I used crisp set QCA as I felt that this suited my outcome condition best; my causal conditions were either out or in. My independent variable (Group 1) was my outcome condition and my causal conditions were dependent variables based on information recorded in the medical notes; observations, previous relevant history, medical examination, bloods, chest x-ray and ECG. I did run other analysis using other dependent variables, as I probed further into my interpretation of the findings. This is discussed in 3.8.4.

c) To analyse the narrative of my overt observation of the physicians' medical assessments of patients, leading to the physicians making their impression/working diagnosis. I used the taped narrative story to explain the physician/patient interaction and my interpretive reasoning from a clinical perspective to analyse the story.

3.8.2 Data from interviews

I decided that I needed to look for commonality and key themes amongst the physicians' responses, to achieve this I developed a coding frame. Punch (2005) describes coding as initially a process of putting tags, names or labels

against pieces of data to allow for a more advanced form of coding which can then enable the summarising of data by pulling together themes.

The analysis I wanted to achieve was a comparison between the individual physicians response to the same questions. This was difficult to do when faced with 16 separate interviews to compare, so, using Word 97, I decided that the way I could make this comparison easier for myself, would be to set each question out separately and then put the answers I received from each physician against it. This was achieved by cutting and pasting each individual question and its answers into separate new documents, this meant that each new document represented the answer to each individual question from each individual physician, for example:

Q.4	Can you describe to me the process you undertake when you are diagnosing a patient following their admission to the ED	Physician's response
		01
		02
		03
		Etc.

Table 3.5 Comparing interview responses

I then transferred this transcription into NVivo 8 using each interview question as a basis for creating my tree nodes, my categories were; the medical diagnostic process, physician/patient interaction, evidence based medicine, clinical reasoning, and percentage of patients who receive the right diagnosis, the use of equipment and any factors affecting the way in which they made their diagnosis.

By using these tree nodes, I was able to then create free nodes under each category which identified the commonality of themes. Although this gave some interesting results, I did not feel that it represented the complete narrative given by the physicians' response, so I decided to use some of the narratives, as an example of the fuller response under the themes I had created. Coffey and Atkinson (1996: 52) suggest:

> Our interview informants may tell us long and complicated accounts and reminiscences. When we chop them up into separate coded segments, we are in danger of losing the sense that they are accounts. We lose sight, if we are not careful, of the fact that they are often couched in terms of stories –as narratives – or that they have other formal properties in terms of their discourse structure. Segmenting and coding may be important, even an indispensible, part of the research process, but it is not the whole story.

3.8.3 Data from my overt observation

Throughout my six-month overt observation, I was careful to manage my data efficiently. I typed up the taped observations, as they were completed, which helped me immeasurably. This date provided a rich narrative of the patient /physician interaction during the medical diagnostic process. Although I had previously typed up my notes I decided that they required tidying up, so that from a reader's perspective it would be easy to differentiate the physician and the patient. The data remained anonymised with the ID number previously allocated to the patient and physician being hidden. This was then replaced by the name physician or patient. During the observation, I managed to gather additional taped data, this comprised of discussions between the junior and

senior physicians, following some of my witnessed observations. This narrative complimented the results from the analysis of the documentary evidence (the medical notes) and the results from the physicians' one to one interviews.

Although my narratives provided explanatory stories, I felt that it would be useful to analyse/interpret each case based narrative using NVivo 8, looking for any emerging themes or commonalities. My focus for this narrative inquiry was the way the patient gave their history regarding their presenting complaints and the physicians' response and actions. I transferred the observation notes from Word 97 into NVivo 8. I then created free nodes, these were; patient complaint, signs and symptoms, duration of onset, previous history, smoking history, alcohol history and family history. I found that this approach did not really give me a great deal of useful analysis, as it was difficult to see any patterns or trends emerging. I decided that to be able to undertake any comparison between my cases, I needed to group the free nodes under some headings. I created four categories of the presenting complaints; chest pain, shortness of breath, collapse and mechanical fall, and then created free nodes under each heading, this provided me with some interesting findings, these are represented in my data chapters, Chapters 4 and 5. Further discussion takes place in Chapter 6.

3.8.4 Data from documentary evidence

The anonymised notes taken from the patients' medical notes were typed up at various times, throughout the fieldwork period. The transcribed patients' medical notes showed the process that the physicians undertook when forming their impression/working diagnosis of the probable cause of a patient's presenting complaint. This was very important for my research, as I wanted to capture each point of that process, particularly any causal conditions that may have

influenced their clinical decision. To enable this to happen, I decided to analyse/interpret this data using SPSS and QCA.

My transcribed notes were typed up in Word 97, therefore, I entered the data from the individual medical case notes into SPSS. The process I undertook was to look at each case separately; to transfer the real information taken from the individual medical notes and to create case-based variables which reflected what was actually written by the physician. Therefore, each case had an ID (identification) number.

Initially, I created 32 case-based variables based on the characters of real cases, the majority of these variables were categorical variables. For each of these case-based variables, I created values and coded them accordingly. This was a complicated process, owing to the fact that although the format of the process was similar, the patients were not, therefore I found myself going back to add values, as I found different entities within the individual patient's medical notes. My main aim at this point was to not miss out any information appertaining to the individual patient, as I wanted to capture every piece of information in the individual case notes, verbatim, as they had been written by the physicians. As each physician/patient case was individual, this meant that I ended up with many values for some of the case based variables, as shown in Table 3.6. I could have simplified this process by using my own clinical knowledge and grouping these values together. However, I was resolute that I would not manipulate this natural occurring data, after all this was the crux of my research.

Initial Variables	Initial Values
Patient ID	Patient number
Patient's sex	1 – Male. 2. Female.
Patient's age range	1.18-25yrs. 2.26-50yrs. 3.51-70. 4. 71-90.5.91+.
Physician's Grade	1. F1. 2. F2 3.ST1/Middle grade. 4. Staff Grade. 5. Registrar. 6. Associate Specialist. 7. Consultant.
Patient's Presenting Complaint	1. Abdominal pain. 2. Chest pain. 3. Shortness of breath. 4. Collapse. 5. Trauma. 6. Mechanical fall. 7. Threatened miscarriage/gynae. 8. Other.
Observations recorded in medical notes	1. Yes. 2.no.
Blood pressure	1. Hypertension. 2. Hypotension. 3. Normal Range. 4. Not recorded in medical notes.
Pulse rate	1. Tachycardia. 2. Bradycardia. 3. Normal range. 4. Irregular. 5. Not recorded in medical notes.
Oxygen saturation rate	1.94 -97 %(a). 2. 98-100 %(a). 3. 94-97 %(02). 4.98-100%(02).
Respiration rate	1.16 -18. 2.19-20. 3. 21+4.Not recorded in medical notes.
Temperature	1. Pyrexial. 2. Apyrexial. 3.not recorded in medical notes.
Chest examination	1. Clear. 2. creps/crackles. 3. Not recorded in medical notes.
Abdominal examination	1. Soft. 2. Distended. 3. Other 4.not recorded in medical notes.
Bowel sounds	1. Present. 2. Absent. 3. Not recorded in medical notes.
Urinalysis	1. yes/nad. 2. yes/positive. 3. Not recorded in medical notes. Urine dip requested.
Previous cardiac history	1. Yes. 2. No. 3. Not recorded in medical

	notes.
Diabetes mellitus	1. Yes. 2. No. 3. Not recorded in medical notes.
Previous respiratory problems	1. Yes. 2. No. 3. Not recorded in medical notes.
Previous relevant history	1. Yes. 2. No. 3. Not recorded in medical notes.
Drug History (prescribed)	1. Regular medication. 2. Nil regular. Not recorded in medical notes.
Social history	1. lives alone. 2. Lives with spouse. Lives with partner. 4. Not recorded in medical notes.5. lives with relatives. 6. Lives in N/H or R/H. 7. Other.
Smoking history	1. Never smoked. 2. Gave up 1-3 yrs ago. 3. Gave up 4-10 yrs ago. 4. Gave up more than 10yrs ago. 5. Smokes.6. not recorded in medical notes.
Alcohol history	1. Doesn't drink. 2. 1-5 units/week. 3. 6-10 units/week. 4. 11+ units/week. 5. Previous ethanol abuse/nil now. 6. Not recorded in medical notes.
Family history	1. Significant cardiac history. 2. Nil relevant. 3. Not recorded in medical notes.
Initial pain level	1. 10/10. 2. 6-9/10. 3. 3-5/10. 4. No pain. 5. Not recorded in medical notes.
Impression/working diagnosis	1. Cardiac pain. 2. Exacerbation of existing condition. 3. Fracture or suspected fracture. 4. Arrhythmias. 5. Muscular pain.6. Chest infection/pneumonia/pleuritic. 7. Miscarriage. 8. Neurological/TIA. 9. Other.
Chest x-ray	1. Yes. 2. No.
Other x-rays	1. Yes. 2. No.
Blood tests	1. Yes. 2. No.
Troponin taken	1. Yes. 2. No.
ECG	1. Sinus rhythm. 2. Abnormal. 3. Sinus bradycardia. 4. Sinus tachycardia. 5.

	Heart block. 6. Not recorded in medical notes. 7. Atrial flutter. 8. Other rhythm. 9. ECG requested.
Plan	1. Admit. 2. Treat/discharge.
Discussed with Seniors	1. Yes. 2. No. 3. N/A.

Table 3.6 - Initial variables and values

Once I felt that I had entered all the information correctly into SPSS, I ran a series of frequencies to check all values that occurred for each of my specified case-based variable; how frequently the values occurred and the percentage of times the values occurred based on the number of cases. This technique showed only cases with valid data for the variable. At this stage, I found a problem with the number of categories in the presenting complaint case-based variable. This was causing some difficulty with cross-tabulating the data; this was due to the fact that some of the categories had only two or three patients in them causing a problem of statistical significance with small numbers. Using my clinical knowledge and interpretation of the data, I decided to undertake some further clustering of the data and to aggregate the categories into two groups, in order to make the results of the analysis clearer:

> Interpreting the results from a cluster algorithm is often dominated by personal intuition and insight. If the investigator can make sense of the clusters produced, the cluster analysis is frequently deemed to be a success (Everitt, 1993 :142 cited by Byrne 2002: 104).

The two groups were now:

Group 1 - comprises of patients with the presenting complaints of chest pain; shortness of breath; collapse, abdominal pain, PR bleed, nausea, vascular and neurological problems.

Group 2 - comprises of patients presenting with trauma; mechanical falls; miscarriage/gynaecological problems, allergies/rashes and dental problems.

Once this had been achieved, I repeated the frequencies analysis for each of my case-based variables to check for errors. The output from this analysis

informed me if my minimum and maximum values made sense and also checked the number of valid cases, and whether I had any data missing. This was important prior to carrying any further analysis. I then re-ran my cross-tabulations.

Initially, I was going to use factor analysis to analyse my data, as this type of analysis is described as being most effective on large sets of variables, as it looks for clumps or groups of closely related data. Unfortunately, other than the age of my patients, for which I had created a continuous variable, the rest of the case-based variables were all categorical. This meant that my variables were not appropriate for undertaking a factor analysis. However, I had already identified my groups, through the process of descriptive analysis using frequencies and cross-tabulation. Thus, I do not think that this was detrimental to my research. This is discussed further in Chapter 7.

Using further descriptive analysis, a pattern emerged showing a difference between Group 1 and Group 2 relating to the frequencies of various variables in each group. It showed that there was more recorded case-based data in the patients from Group 1 medical notes than in the case-based data of the patients in Group 2. For example, more observations were recorded in the medical notes for Group 1 patients (Chapter 4.6.3). Although this was an interesting finding, it did not provide any insight into individual cases and how these cases compared to each other. To achieve the best outcomes from my data, I decided to use crisp set qualitative comparative analysis, this analytical process is based on Boolean algebra. Prior to using QCA, I already had in-depth knowledge about each case and owing to my clinical knowledge; I understood my case-based variables very well.

To undertake crisp set analysis I had to recode my case-based variables to dichotomous variables using 0 and 1, for example; blood pressure recorded in the medical notes, 0 – no and 1- yes. I used the SPSS data base I had created, as discussed previously. Using QCA I was able to transfer the data base from SPSS and then to start a crisp set analysis on my data. This was achieved by choosing an outcome variable that I wanted to explore and then choosing the causal variables. For my outcome variable I used the independent variable, Group 1 and for the causal dependent variables I used the following causal variables:

Obsrecord (Observations recorded in medical notes) 0=No. 1=Yes.

PRH (previous relevant history recorded in medical notes) 0=No. 1=Yes.

Bloods (bloods recorded in medical notes) 0=No. 1=Yes.

Exam (medical examination recorded in medical notes) 0=No. 1=Yes.

CXray (chest x-ray recorded/requested in medical notes) 0.=No. 1=Yes

ECG (ECG recorded/requested in medical notes) 0=No. 1=Yes.

My thinking behind using these variables was so that I could test my theory. This was that the physicians gathered and recorded more information regarding the patients in Group 1 than in Group 2, owing the fact that the patients in Group 1 had more uncertain conditions, therefore making the probable cause of the patient's illness/disease more difficult to diagnose. For example; was 'observations recorded in the medical notes a necessary causal variable for a patient to be in Group 1' or was it a sufficient causal variable. In other words, to what extent is the statement; blood pressure recorded in medical notes is

necessary for Group 1 consistent. The results from this analysis are discussed in the Chapter 4.7.2.

These analyses provided some statistical evidence regarding the difference in the recorded data between the two groups of patients. However, it also threw up more questions that had to be answered. The results still did not explain how/if the causal variables(conditions) influenced the physicians' clinical reasoning leading to his/her forming a medical diagnosis.

Next, I focused on the case-based data where individual cases showed recorded abnormal observations, examinations or investigations. My reasoning for this was that pathophysiology knowledge had been evidenced previously as being vital in the medical diagnostic process (Chapter 4. 2).The main questions were: are abnormal observations a necessary causal variable in the medical diagnostic process? How do abnormal observations influence the physicians clinical reasoning?

To answer these questions I needed to 'dig deeper' into my case-based variables. I was now interested in looking for the abnormal values. I had to revisit my data base and re-code the variables relating to observations and examinations from categorical variables into binary variables, so that I could re-run the crisp set analysis. The original values are shown in Table 3.7.

Observations/Examinations	Values
Blood pressure	1. Hypertension. 2. Hypotension. 3. Normal Range. 4. Not recorded in medical notes.
Pulse rate	1. Tachycardia. 2. Bradycardia. 3. Normal range. 4. Irregular. 5. Not recorded in medical notes.
Temperature	1. Pyrexial. 2. Apyrexial. 3.not recorded in medical notes.
Respiration rate	1.16 -18. 2.19-20. 3. 21+4.Not recorded in medical notes.
Chest examination	1. Clear. 2. creps/crackles. 3. Not recorded in medical notes.
Abdominal examination	1. Soft. 2. Distended. 3. Other 4.not recorded in medical notes.
Diabetes mellitus	1. Yes. 2. No. 3. Not recorded in medical notes.
Urinalysis	1. yes/nad. 2. yes/positive. 3. Not recorded in medical notes. Urine dip requested.

Table 3.7 – Original categorical variables and values

When originally coding these categorical variables I used my clinical knowledge to interpret the data. My interpretation is shown in Table 3.8. This shows the values that I used to decide on what qualified as a *normal* observations/examinations.

Observations/Examinations	Normal Range
Blood pressure	Younger average 120/80. Older average 140/90.
Pulse rate	60-90 beats per minute.
Temperature	37^0C.
Respirations Rate	60-90.
Chest Examination	Clear.
Abdominal Examination	Soft.

Table 3.8 – Interpretation of normal values

When re-coding the categorical variables into binary variables I used 1=abnormal and 0=normal/not recorded in medical notes. Table 3.9 shows the new re-coded case-based binary variables.

Clinical data	Coded 1	Coded 0
Blood pressure reading	Abnormal	Normal/Not recorded in the medical notes.
Pulse rate	Abnormal	Normal/Not recorded in the medical notes.
Temperature	Pyrexial	Apyrexial/not recorded in the medical notes.
Respiratory Rate	21+	Normal/Not recorded in the medical notes.
Chest examination	Creps/crackles	Clear/not recorded in the medical notes.
Abdominal examination	Distended	Soft/not recorded in the medical notes.
Diabetes	Yes	No/not recorded in the medical notes.
Urinalysis	Positive/urine dip requested	Negative/not recorded in the medical notes.

Table 3.9 – New case based binary variables.

For the purpose of this analysis I broke down the two groups, Group 1 and Group 2, into their original individual components and used my newly created binary variables against the cases with the presenting complaints of; chest pain, abdominal pain, trauma, collapse, mechanical fall and shortness of breath. I checked my data was clean by running frequencies and cross tabulations on each component, to confirm that I was still dealing with the same data as previously used in any other analyses I had performed. Once I was content that my data was 'clean' I undertook a cross tabulation comparing the abnormal observations recorded in the medical notes for patients in Group 1 and for the patients in Group 2 with the original presenting complaint categories: chest pain, abdominal pain, trauma, collapse, mechanical fall and shortness of breath (Chapter 5.3.3). My next step was to examine the influence the presenting complaint, abnormal observations and abnormal physical examination may have had on the physicians' clinical reasoning leading to him/her forming their impression/working diagnosis (Chapter 5.3.4).

To explore the data further, I decided to focus on the impression/working diagnosis formed by the physicians. The categories used for this analysis were: chest pain, chest infection and fracture/probable fracture. This allowed me to link the clinical data (abnormal data) to an impression/working diagnosis. This did not provide me with any case based findings so I re-ran a QCA crisp set analysis for each category. This provided me with inconclusive results, which are discussed in Chapter 5.4 and Chapter 6. Next, to examine causal attribution, I explored my data manually using each individual patient case in the following impression/working diagnosis categories: cardiac chest pain, chest infection, fracture/suspected fracture and gallstones/gastric (Chapter 5.4.2). These findings are discussed in Chapter 6.

3.9 Concluding comments

The methodological approach and mixed methods I have used in my research were designed to help me answer the research question ‘ how do physicians diagnose illness and disease in a medical setting’?. I wanted to answer this question to the best of my ability by seeking the truth. Williams argues that search for the truth is a necessary component of a historically and socially situated objectivity.

Williams (in Letherby et al 2012: 113) suggests that:

> Objectivity, like any values, will always be situated. It is not a binary variable – one is not simply objective or not objective. Just as we assess historical actors in their context, so we must assess objectivity in its context.

My research had the three necessary values of objectivity; purpose, differentiation and truth (Williams in Letherby et al 2012: 96). The purpose was to investigate the medical diagnostic process, which shaped my activity. I differentiated between different logical categories and I pursued truth from my perspective. I recognised that the values that I had gained through my clinical training, practice and lifetime experiences would impact on my objectivity as a researcher and were unavoidable.

> ... what we do and how we do it affects what we get. Another way to put this is to say that who we are affects what we think we know. One important conclusion of this is that social scientists have a responsibility to ensure that when they speak about other people, they do so on the basis of warrantable knowledge. The audit trail through research question, methods, data collection, analysis and interpretation needs to be clear, systematic and explicit (Oakley 2004: 191).

This subjective position had implications for my work and the choices I made. From a positive perspective, I felt that I was in a good position to undertake the research, I had clinical experience which meant that I understood medical terms and jargon. I was familiar with having contact with physicians and patients in a clinical setting and I understood the ‘politics’ within the NHS. On the negative side, I had to acknowledge an inherent sense of loyalty to my fellow health professionals and the NHS.

Letherby (Letherby et al 2012: 125) argues for a position she calls theorised subjectivity which acknowledges that all research is inevitably objective and ‘recognises the values - both positive and negative - of the subjective’. This has meant that by understanding the negative and positive values I brought to my research, I have been able to acknowledge their impact in relation to my data collection and subsequent analysis and interpretation of the data. I have strived throughout the research process to avoid influencing the outcome. I used a mixed method approach to provide a qualitative and quantitative view of the medical diagnostic process. When I designed the physicians questionnaire, I based the questions on previously published research to reduce ambiguity. I used transcripts of original taped narratives recorded during my overt observation to illustrate the actual dialogue of the physician/patient interaction that had taken place and I meticulously copied the medical case notes verbatim. I also ensured that my analysis/interpretation of the data remained as transparent as possible from the coding of my case-based variables, grouping of categories, variations in variables to my interpretation of the data itself. This was due to my desire to provide an explanation that has been based on real information, as I did not wish to infer anything regarding the medical diagnostic process that could not be substantiated by the original data. I therefore believe

that by understanding my subjective self I have attempted to objectively pursue the truth:

> Theorised subjectivity acknowledges that research is a subjective, power-laden, emotional, embodied experience but does not see this as a disadvantage, just as how it is. Starting with subjectivity though does not mean that we shrug our epistemological shoulders and give into the subjective, indulging in our subjectivities. Rather it requires the constant, critical interrogation of our personhood – both intellectual and personal – within the knowledge production process (Letherby 2012: 122).

As a result I have rich narratives which support the quantitative findings, therefore providing the explanatory story regarding the clinical reasoning and causal attribution undertaken by physicians when undertaking the medical diagnostic process. The following three chapters show the results of the data I collected using my mixed method approach and discuss their relevance to my research study.

Chapter 4 – Medical diagnosis – the step process

4.1 Introduction

This is the first of three data chapters focusing on data analysis. The aim of this chapter is to show the step process of gathering information undertaken by physicians when clinically assessing patients on their arrival in an Emergency Department. The medical diagnostic process is complicated, it consists of a sequential step process and clinical reasoning. This leads to the physicians forming a clinical decision of the probable cause of a patient's presenting complaint. The data presented in the main sections of this chapter show how and why physicians gather information; what information is gathered and how this information varies depending on the uncertainty of the presenting complaint (what the patient said was wrong with them).

Following this, in Chapter 5, I show the way in which the information gathered by physicians inform and influence their clinical reasoning and how this leads to the formation of their impression/working diagnosis of the cause of the patients' presenting complaints. The data analysis illustrates that the process of gathering information and clinical reasoning are strongly interdependent and although the process is taught, the clinical reasoning is actually acquired over time; building on the taught foundation of biomedicine/pathophysiology knowledge and empirical knowledge through experiential learning. This illustrates the interdependence of the art of medicine and the science of medicine (Chapter 2.2). In Chapter 6, the final data chapter, I discuss in more detail the findings presented in Chapters 4 and 5.

4.2 Respondents

4.2.1 Physicians

My respondents were physicians working in the ED (For detail see Chapter 3.1.5.1). Table 4.1 shows the breakdown of the number and grade of the physician respondents and the percentage of patients seen by each physician during my overt observation. It was useful to have a mixture of novice and expert physicians, as this allowed me to explore any similarities or differences in the way in which they diagnosed the cause of patients' presenting complaints.

Grade	Number	% of patients seen by each grade(n.202)
Consultants	5	5 % (10)
Registrars/Specialist As/Clinical Fellow	5	24 % (49)
Staff Grade/ST4/ST1	8	30 % (60)
F2	2	13 % (27)
F1	4	28 % (56)
Medical Student	2	In training with seniors.

Table 4.1 - Grades of physicians

The distribution of grades is reasonably spread between junior and senior physicians. (see Glossary at front for detail). The percentage of patients seen by each grade provides comparative data.

4.2.2. Patients

My consenting patients attending the ED.

4.2.2.1 Patient's Presenting Complaint

The patients were admitted to the Emergency Department with a range of presenting complaints. As shown in Chart 4.1:

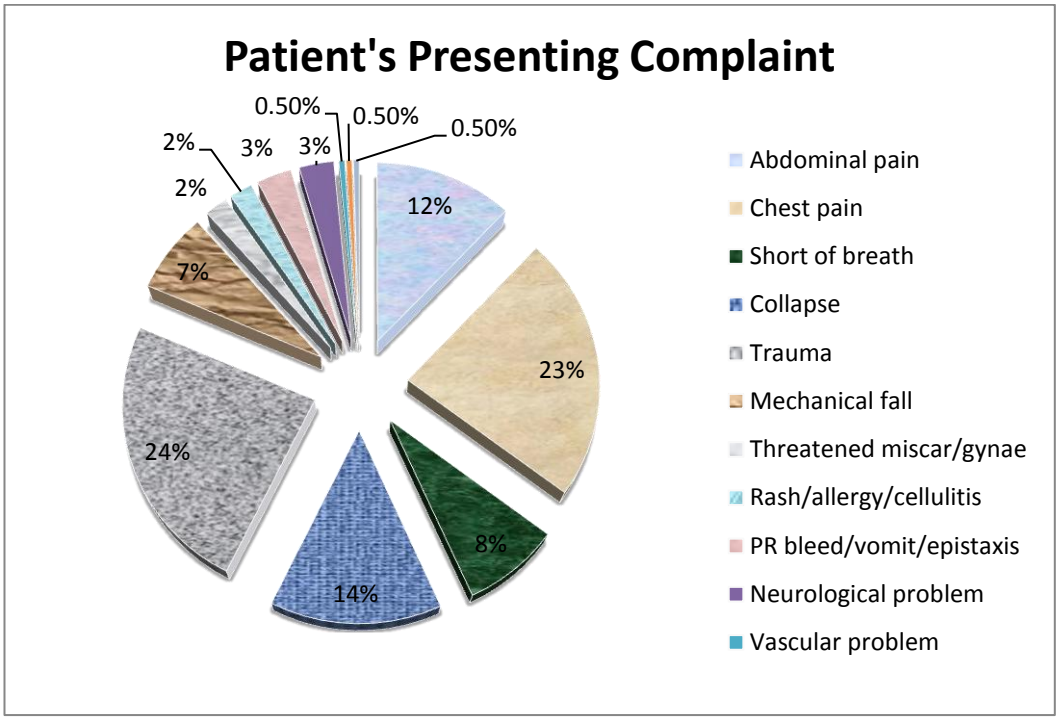


Chart 4.1- Breakdown of patient's presenting complaints

4.3 Gathering information – How and Why?

A physician is taught the basic steps in the medical diagnostic process at medical school (Chapter 2.4). These steps are taken to gather as much information as possible from which to form a medical diagnosis of the probable cause of the patient's presenting complaint.

4.3.1 The process used

When asked to describe the process they undertake when they are diagnosing a patient following their admission to the ED, physicians' individual responses were very similar.

- Taking a history from the patient
- Examination of the patient
- Observations/ Investigations
- Gather information
- Read ambulance sheets.

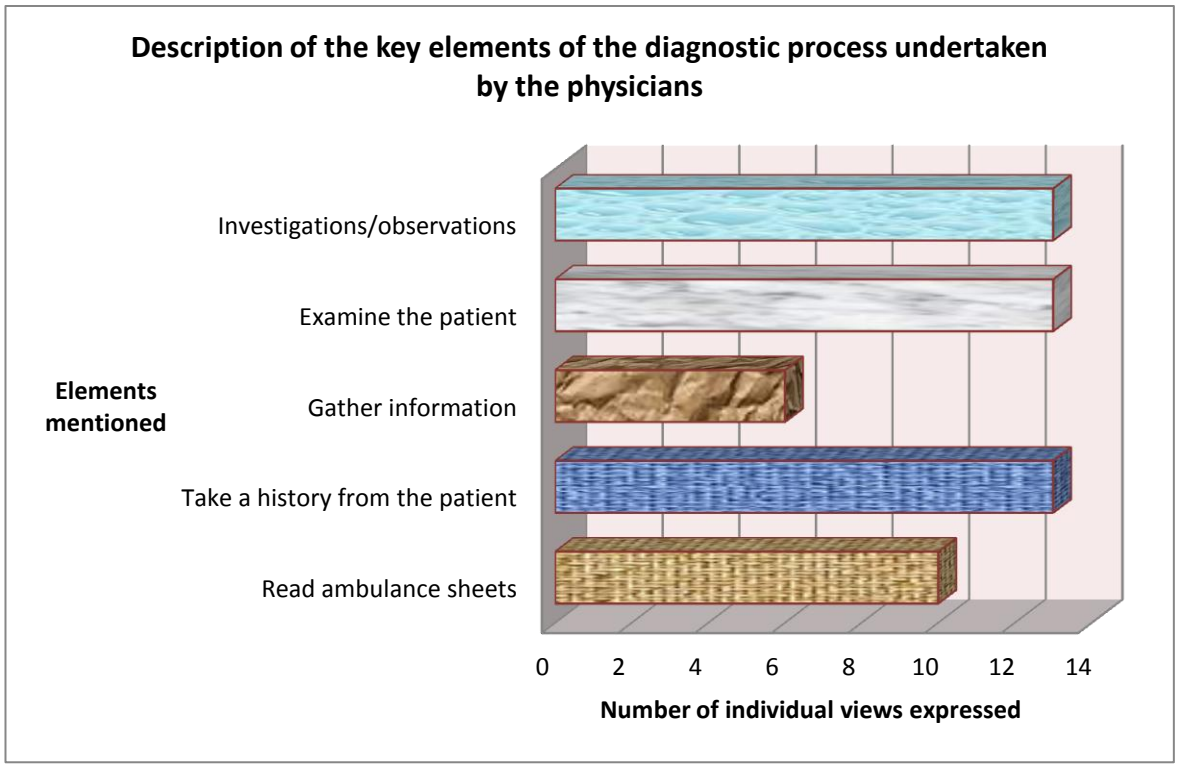


Chart 4.2 – Key elements of diagnostic process

Physicians felt that the first key step in the medical diagnostic process was to gather information by gaining the patient's history, either from the patient themselves or other sources. The next step in the process was the physical examination of the patient. The use of observations and investigations were regarded as another key element in the step process (Chapter 2.4).

4.3.2 Why physicians used this process.

Physicians gave several reasons for undertaking the process shown in 4.3, most commonly one of the following:

- it filters information/clues/narrowed it down.
- it was logical/thorough and comprehensive.
- It was how they were taught at medical school.

Further analysis of the interview narratives showed that physicians felt that following this taught sequence of logical steps, helped them to avoid missing any salient clues and that this facilitated them safeguarding their clinical practice:

> *Keeping to this logical order prevents you missing anything. It's the way you are taught at Medical school* [Interview P.04].

> *Um...Because it is the sort of logical method that we were taught at medical school* [Interview P.03].

What I was taught at medical school [Interview P.16].

It's the system I was taught at medical school, seems to work. Often find extra information from relatives/homes/ambulance crew. Allows me to put all information together to come to logical (hopefully) conclusion/diagnosis [Interview P.21].

The process made them feel more comfortable and safer. Physicians felt that it helped them to avoid making clinical mistakes:

It is a more comprehensive this way. It covers all the bases. It is safer; you work from the top down and rule out nasty things [Interview P.09].

So I don't get struck off! Basically it is the best way of finding a diagnosis by...if you were to do things before you have taken a history or before you have spoken to the patient you can make mistakes [Interview P.17].

In general terms make decisions based on clinical stuff rather than results. Pattern recognition also makes you more comfortable [Interview P.13].

In this way, by using the process they felt more able to manage uncertainty (Chapter 2.4). They focus on the circumstances of the individual patient and assess on the best way to manage that patient's care safely:

I undertake this process because it is thorough. It also leads one very early on to determine if the patient is sick and needs to be moved to another area or needs immediate treatment. In everyday medicine, because of the nature of presentations to ED. I assume the worst diagnosis and then rule out or rule in [Interview P.11].

Physicians felt that the use of the process was like being a detective, going through a logical sequence of steps, looking for clues to solve a mystery:

You have to be like a detective. Everything the patient says, does, how they look, interactions with relatives/staff gives **clues** *as to what the problem might be. It might not be the obvious thing in front of you. Sometimes look deeper.* [Interview P.06].

Firstly, gain a broad picture, and using information gained from history, examination, investigations, start to filter the information into what's relevant and pointing to the most likely diagnosis/es [Interview P.19].

4.4 Gaining a patient's history

Gaining information through taking a patient's history and the physician/patient interaction has been established as being an important part of the medical diagnostic process (Chapter 2.6). Gaining the patient's history was mentioned by 81% of the physicians as being a key element of the medical diagnostic process. This is consistent with a study carried out by Hampton et al (1975)

who found that the medical history provided enough information for physicians to make an initial diagnosis that agreed with the final diagnosis on 83% (66/80) of the patients in a general medicine clinic. Another study carried out by Sandler (1979) reported that for 630 medical outpatients, history was the most important component contributing to diagnosis with 56% of patients, whereas physical examination was most important in 17% of cases and investigations most important in 23% of diagnoses.

Greenhalgh and Hurwitz (1998:247) suggest that 'patient narratives provide a possibility of understanding which cannot be arrived at by other means. It defines how, why and what way he or she is ill'. Whilst, I agree with their view, I found that in the ED the patient narratives were instigated and structured by the physician' questioning. The physicians led the interaction with the patients starting with an open question. This open question was very general such as the physician asking the patient: 'can you tell me what has been happening?' The physicians soon followed this with specific questions related to trying to establish the cause of the patient's presenting complaint. The physicians' biomedical/pathophysiological/empirical knowledge (Chapter 2.7.1.15 and 7.1.16) informed this questioning which was based on the patients' signs and symptoms of the illness/disease.

Physician respondents informed me that their questions were dependent on the patient's presenting complaint. In fact, 63% physicians interviewed said that the questions they ask their patients are driven by the patient's presenting complaint and 37% said that it depended on the patient's symptoms. There was consistency within the junior and senior physicians response to the question

‘How do you decide on which questions to ask the patient, when gaining their medical history?’ I have split their responses into two categories; junior physicians with six-months to two-and-a half-years experience and seniors with four to 23 years experience. My reasoning for presenting these responses in this way was to show the similarities in the responses. This finding does tend to question the views of others regarding the novice and the expert (Elstein et al 2002; Norman 2006) previously mentioned in Chapter 2. I explore the differences between novice and expert (junior and senior physicians) further in Chapters 5 and 6.

4.4.1 Interview narratives from physicians who had six months – two and half years experience.

As previously mentioned, physicians ask standard questions based on the patient’s presenting complaint. In the following interview narratives, junior physicians explained how they decide on the questions to ask the patient to gain their medical history:

> *Standard questions you are taught. Adapt according to their presentation* [Interview P.16].

> *You are guided by their presenting complaint. Questions to patient. Then standard questions regarding previous medical history, drug history, allergies etc, that you ask every patient* [Interview P.04].

> *Questions related to their presenting complaint initially. Questions that help rule in or rule out certain conditions. One question plus answer often*

leads to next question naturally. Often have own list of important questions in mind that ask for that relevant symptom almost automatically [Interview P.19].

Um, I guess they are prompted by their presentation, so I ask a vague open question to find out why they come in and then start to ask more closed specific questions related to their type of presentation or the problem they have come in with [Interview P.03].

Depends on presenting complaint/age of patient. I suppose questions shaped by what responses I have had in the past. Whether I cause the patient embarrassment or confusion etc [Interview P.21].

The junior physicians' questioning was based on their biomedical/pathophysiological knowledge. The presenting complaint indicates the system involved, for example; cardiac, respiratory or digestive. Physicians then ask standard questions appertaining to that system. The following interview narratives show how this works in clinical practice:

A bit of commonsense and also you get taught at medical school...if it is this system that is wrong...if it is the heart, there are certain questions you have to ask really and you can either rationalise it by learning it parrot fashion like most people do or you can do it by learning rationale, underlying physiology, pathology, biology [Interview P.17].

The way in which junior physicians asked the patients questions were very similar. Although they start with an open question, they soon focus on the presenting complaint and link it to a system. This way of thinking is clearly demonstrated in the following interview narrative:

> *Asking questions isn't the first thing I do, the first thing I do is listen. Well I ask an open question, I suppose, ask them why they came in, what their problem is, what brought them in...I am listening and even as I am listening I am trying to formulate a possible diagnosis. I ask questions that might provide more clues, for example if someone comes in with chest pain, I might ask them,for example does it get worse with exercise, which might point towards a cardiac cause for the pain. Does it get worse when you take a deep breath, which might point to a pleuritic form or does it get worse immediately after you have eaten, which might point to a gastric cause for the pain. I am asking questions about their pain that may give me clues to what their pain is* [Interview P.08].

4.4.2 Interview narratives from physicians who had experience ranging from four years to 23 years.

By comparing the interview narratives from junior physicians and senior physicians, I found that the senior physicians responses were similar. In that, they also used standard questions based on the patient's presenting complaint:

That is not too difficult, you have got a standard set of questions that I have got in my mind that you ask which then can expand depending on what the patient may answer [Interview P.02].

Ok, how you decide on the questions depends on what the patient is presenting with. The questions I ask will be concerned with what the presenting complaint is, so if abdominal pain, you would ask where the pain is, what the pain was like. If it is a collapse, then we start by asking what they were like before the collapse, when they collapsed, were they aware of it, were they conscious. So...what guides the questions is why is the patient in hospital [Interview P.10].

It depends on symptoms – for most symptoms e.g. pain we are taught a set of questions – focus on what they came in with – or specific [Interview P.13].

Senior physicians interview responses concurred with junior physicians responses regarding the use of their biomedical/pathophysiological knowledge when questioning the patients. They also focused on the presenting complaint and linked it to a system. However, there was a slight difference here to the juniors physicians responses as senior physicians appeared to ask broader questions involving other systems. This is highlighted in the following interview narratives:

Rather depends on what they come in with, um. If they have come in with a respiratory problem, I often do a focused respiratory history, but I will

also do some screening questions as well. Have you had chest pain? Have you had a headache and so on and so forth. Things that will identify other problems [Interview P.09].

I guess it depends on what they come in with. I guess it depends on their mental state and their level of functioning, as to whether you make it really simple...Some patients come in knowing a lot about medical problems already and give you a load of information. So I think my questions are more generic...if someone comes in with a respiratory problem or chest pain then I probably end up asking the same questions as everybody else. But I may use different wording depending on what I think they understand [Interview P.18].

Initially questions very broad based and then hone in on the questioning to get specific answers to rule in or rule out diagnosis. Depending on what the symptoms are, I may ask more specific questions. If they have very generalised symptoms or can't give much history, I do a full symptoms review and full examination(pertinent to ED to aid diagnosis [Interview P.11].

The following interview narratives show how senior physicians also start with an open question and how they control the physician /patient discourse:

I start with an open question always and that then gives you an idea of what is going on. Tend to let them chat for a bit of time, supposed to be three minutes, but I am sure it is much less than that. Probably about one

minute before I get bored(laughter). I tend to then narrow them down and tend to ask closed questions after initial open questions. So... one to three open questions to start with and then closed questions [Interview P.14].

If the patient is alone you ask questions to establish why they came into ED today, what happened, anything leading to event. You have to find answers to your questions. Sometimes it is easy, sometimes it is very hard. You go with the flow, allowing the patient to tell you but at the same time remaining in control of the situation. It varies [Interview P.06].

Ansell and Hiremath (2001) suggest that the knowledge base of physicians varies and so does their ability to collect a patient's history. Whilst I agree with the fact that the knowledge base of physicians does vary according to their experience, my study has shown that the approach taken when collecting the patient's history is remarkably similar with both junior and senior physicians. The influence that this questioning and the patient's subsequent history had on the physicians' clinical reasoning will be discussed further in Chapters 5 and 6.

4.4.3 The use of biomedical knowledge when gaining a patient's history.

As shown in 4.4.1. biomedical knowledge seemed to underpin the questioning that took place in the ED. I asked one of the ED consultants to expand on the role biomedical training plays in the medical diagnostic process, he responded:

> *I think it is very important. I did not realise how important it was when I was at medical school but something I have found since being a consultant and before is how important it is to know anatomy and physiology to make a correct diagnosis and also to give the appropriate treatment* [Interview P.01].

This biomedical knowledge learnt at medical school (Chapter 2.3 and 2.7.1.15) is not just about how the body's organs normally function but also about pathophysiology (Chapter 2.7.1.16.) changes of normal, physical and biomedical functions either through disease or conditions. The importance of the signs and symptoms displayed by the patient and their relationship to the medical diagnostic process was summed up in the way in which physicians questioned the patient. This knowledge is also shown to play an important part in physicians clinical reasoning (Chapter 7.3.2).

4.4.4 Comparison of questions.

As previously established, physicians based their questioning on the patients' presenting complaints. The following tables show a selection of the questioning that took place. It shows similarities and differences between some groups of presenting complaints. This information was collated from the taped notes taken during the non-participation observation (Chapter 3.6.2.1).

Selection of questions asked to patients with the presenting complaint of chest pain:
Have you got pain at the moment?
When did the pain start?
How long ago did it start?
How long have you had pain like this?
Do you do anything that brings the pain on?
When does the pain occur?
Describe type of pain to me
Can you describe where the pain is?
Does it go anywhere else?
Do you get sweaty?
Did you feel lightheaded?
Any shortness of breath?
Does anyone in family have heart problems?
Do you suffer from diabetes?
Do you smoke?
Do you drink?
Was the pain tight?
Did it go up to your neck?
Do any positions make it better or worse?

Table 4.2- Selection of questions asked of patients with the presenting complaint of chest pain.

Selection of questions asked to patients with the presenting complaint of abdominal pain:
Is your pain worse when lying down?
Is it at the top of your abdomen?
When did it start?
Does the pain come and go?
What tablets are you on?
Are you usually fit and well?
Where are you sore in your tummy?
Have you had a pregnancy test?
Any blood or discharge?
Have you had your bowels open normally?
When was your last period?
Have we had a urine test from you?
Can you tell me where the pain is? What sort of pain is it?
Is the pain an aching pain or sharp or stabbing?
Does the pain go anywhere else?
Any nausea or vomiting?
Are your bowels open ok, no blood?
Is the pain associated with food?
Does the position you are in make a difference?

Table 4.3- Selection of questions asked of patients with the presenting complaint of abdominal pain.

Selection of questions asked of patients presenting complaint of having had a fall:
So you fell, do you remember how you landed?
Previously fit and well?
Where are you hurt?
You slipped?
Do you remember everything about the fall?
How are you usually?
Anything I should know about you?
So you have a clear memory of when you fall?
Did you feel giddy or faint?
What medication are you on?
Did you lose consciousness at all?
Do you feel sick?
Have you got a headache?
Are you normally independent?
Any double vision?
Do you have any medical problems

Table 4.4- Selection of questions asked of patients with the presenting complaint of having had a fall.

Selection of questions asked of patient with the presenting complaint of palpitations.
Where were the palpitations?
How long did it last?
Did it feel regular?
No pins and needles?
Did you have any slurring of your words?
Any pain in the chest?
Any blackout or unconsciousness?
How long did it last?
Any coughs or colds?
Are you well otherwise?
Bowels and waterworks ok?
No fever or anything?
Do you drink much alcohol? How many units?
Any heart attacks or strokes?
Any family history?
Did it wake you up?
Any weakness in your arm?

Table 4.5- Selection of questions asked of patients with the presenting complaint of palpitations.

Selection of questions asked of patients with the presenting complaint of shortness of breath.
Have you had any pain?
Do you get out of breath when you are sitting?
What other medical problems do you have?
Have you ever had a stroke or heart attack?
Any operations?
Do you smoke?
So you were well until a couple of days ago?
Are you coughing up anything?
Have you difficulty in breathing?
How do you get around usually?
Do you still smoke?
Where was the pain?
Any recent hospital admissions?

Table 4.6- Selection of questions asked of patients with the presenting complaint of shortness of breath..

These tables show that the questions asked regarding chest pain and abdominal pain were similar. They focused on the location of the pain, type of pain, duration of pain, whether the pain radiated elsewhere and if positioning altered the pain. The questioning also showed that the physicians asked different questions about any other signs and symptoms appertaining to the patient's presenting complaint.

In the categories of presenting complaint chest pain or shortness of breath, the questions asked related to previous history of cardiac or respiratory problems.

Other questions in these categories related to contributing factors such as smoking or alcohol. The questioning in the cases with a presenting complaint of abdominal pain tended to deal with the patient's bowel habit and urination. Female patients of child bearing age whose presenting complaint was abdominal pain, were asked questions regarding their menstrual cycle.

The questioning that took place when a patient had had a fall, focused on how the patient fell. The physicians tried to establish if there were any predisposing factors such as giddiness or faintness prior to the fall, or had the patient just tripped over something. Questions were asked regarding the patient's prescribed medication; had there been any changes in medication recently. Lastly, the physicians asked questions to establish if the patient had suffered any injuries.

The questioning of the patient presenting with palpitations tended to focus on the presenting problem. The physicians search for any previous medical history and further signs and symptoms that could relate to a slight stroke, like weakness of the arm or slurring of the speech. *(This was owing to the fact that sometimes a very irregular heart beat can cause an embolism (clot of blood or debris from the heart to enter the circulation and go to the brain causing a transient ischemic attack or stroke).*

The questioning of the patient with the presenting complaint of shortness of breath tended to focus on the problem itself. The physicians asked about the patient breathing and if there was any pain. They asked if the patient had a cough and if they did were they coughing up sputum. Lastly, they tended to probe the patient's past medical history and any predisposing factors, such as smoking.

This information is discussed further in Chapters 5 and 6.

4.4.5 Patient and Physician Interaction

To enable the gathering of information concerning the patient's history, physicians acknowledged that their interaction with patients was essential. This interaction helped them to gain the information they required to help them formulate an impression/working diagnosis as to the cause of the patient's presenting complaint. Effective communication was seen as crucial in building trust and a rapport with the patients. Physicians were also aware of the necessary role their knowledge base played in the questioning of patients to gain their history.

Knopp et al (1996) suggest that physicians skilled at working in an emergency department can establish rapport and trust in the first few minutes of an encounter while rapidly gathering information vital to diagnosis and treatment. I concur with their suggestion. I witnessed this myself first hand during my observations in the ED.

When asked about their interaction with the patient and the role that it played in their ability to gather information during the clinical assessment, physicians responded in a comparable manner. The main reasons given are shown below:

- it built a rapport with the patient
- good communication skills important
- building trust/confidence/relaxing the patient important

Further analysis of the interview narratives, found that the majority of physician respondents emphasised the effect that the patient/physician interaction had on them personally as physicians, such as them ‘getting what they wanted’, which was good information.

The following interview narratives show the physicians’ emphasis on building a rapport with their patients and why a good physician/patient interaction was seen to be important in helping physicians gather the information they required. The interaction is shown to be built on respect for the patient, which in turn, helps the patient to build trust and confidence in their physician:

> *Important to build a rapport with patient as tend to get more accurate information from them if they trust you* [Interview P.21].

> *Very important to get a good interaction and quickly establish a rapport, otherwise won’t get adequate history. Always treat patient with respect* [Interview P.11].

> *Important I build up a rapport and patient has confidence in you* [Interview P.16].

> *Forming a rapport with the patient helps immensely in gathering information, especially personal. Communication skills are vital here – being able to relate on the same level. Equal doctor – patient interaction important to relax the patients and also inspire confidence in them helps* [Interview P.19].

It's very important. Without a history or if the history is difficult to obtain for any reason it makes the assessment much more challenging. Making a good rapport is important for assessment but also treatment [Interview P.04].

The following interview narrative shows that whilst this physician saw the importance of building a rapport with the patient, it was not always easy to achieve. This was especially true if a patient was in pain or distress and required a physical examination which added to their discomfort. This narrative also acknowledges that there are some patients with whom it is not possible to build a rapport, because of their personal nature:

Of course you have to have a rapport with the patient. If you go in like a bull in a china shop, like the lady with the knee. You have to apologise that you will have to try and move it, but let her know it will hurt and you are very sorry. Being nice to patients is important. They come here because they are unwell, they feel they are unwell, especially the ones brought in by ambulance. It can be quite an intimidating experience for them. Be nice to the patient and you will get a good response, there are some exceptions with patients who are just horrible no matter how nice you are [Interview P.10].

The physician /patient interaction was used as a way of assessing the patient. The physician narratives show how they note how the patient responds to their

questioning. Is the patient lucid or confused? Are they drowsy or alert? Are they drunk or sober etc:

> *It is vital! How they interact with you and others gives you a clue as to what the problem is. Are they alert? Awake? Are there other issues, for example psychiatric or abuse problems* [Interview 06].

> *Yes.[Prompt-how]The people that have/just look annoying/instinct...may have a proper disease but also a lot of psychological problems. I try not to let it prejudice my decision too much* [Interview P.14].

> *Um, well I guess it is going to give you extra information, if their interaction is confused or aggressive, it may be pointing to other things going on. It is all extra information, their behaviour and the way they interact* [Interview P.03].

The use of good non-verbal and verbal communication skills was seen to be the crux of the physician / patient interaction:

> *Yes, absolutely. Communication is crucial, non-verbal and verbal. We see all types of patients in ED, from sprained ankle to mental health problems, paediatrics, vulnerable adults etc. My communication is important with not just the patients but the carers and relatives* [Interview P.01].

Yes, definitely. Um, firstly I think by starting with an open question and allowing them to speak, you are giving yourself the widest possible range of information. Also the very manner in which you hold your body, you know, the body language, the eye contact, acknowledging what they are saying or by acknowledging pain and trying to address pain ..shows it is not just a job for me, it is about caring for people. And all this I hope will make the patient willing to share things [Interview P.08].

The following interview narrative shows how non-verbal clues from a patient can help to inform the gathering of information regarding the patient's history:

Yes, so many non verbal clues. Patient subjective interpretation is not always objectivity. For example, short of breath but then caught going for a smoke. First glance [Interview P.13].

Physicians recognised the feelings of the patients, their anxiety and fear when admitted to the ED. Therefore the physician/patient interaction seen as very important to allay that anxiety:

Yes, I think it is very important in an emergency department, as our patients are usually quite ill, and probably frightened as well. You have a relatively short time to establish trust with the patient for them to accept you and your decision and diagnosis is something they feel very anxious about. It is very important. Therefore, I think that you interaction with the

patient might improve that trust which is always helpful or it might not [Interview P.02].

Absolutely, building a degree of rapport. You can come in and sound very light hearted but you are actually relaxing the patient...a lot of people take a history from a fast history, but you can take a bit longer. I think it is important to understand that they need to relax to tell you everything [Interview P.17].

4.4.6 Factors affecting the gathering of information

The gathering of information has been established as an important part of the medical diagnostic process (Chapter 2.6). I was therefore interested to see if there were any factors that affected the way in which the physician gathered their information. Time restraints were mentioned as being the biggest problem and although studies have been undertaken examining the impact that time restraints have on emergency departments, I could not find any literature regarding the impact that this time pressure may have on the physician/patient interaction or the physicians ability to gather information. Flowerdrew et al (2011) undertook a qualitative study using semi-structured interviews to examine teams under pressure in the emergency department. They interviewed 22 nurses and doctors and asked them about the main stressors such as; the four-hour wait, excess workload etc. The findings were related to the operational issues of the department rather than any impact on the patient/physician encounter. These operational issues concern the time taken in transferring patients to other receiving wards or teamwork within and outside

the department. Some other literature was found regarding the impact of busy emergency departments, but these were mainly discussing the risk of litigation and once again this was concerning operational issues or diagnostic errors (Chapters 2.6.1 and 6.7).

The following interview narratives show the physicians' concerns regarding time constraints. Many of these constraints stem from the four-hour waiting time government led initiative, where patients have to leave the ED within four hours of their admission:

> *Yes, there is always time pressure, we are always busy and there is a pressure on us to see patients quickly because of the volume the workload, lack of physicians in the department. Time constraints. External targets, 4 hour wait. We have good support from other departments, particularly radiology* [Interview P.01].

The time constraint places an added pressure on physicians to form an impression/working diagnosis and then to decide on the management of the patient by either admitting or discharging them:

> *Yes, worry about litigation. Worry may not have enough time or resources in*
> *ED to rule out? Therefore admit* [Interview P.11].

The physicians expressed their concerns regarding factors that can delay the information gathering process and therefore add to their anxiety regarding the time pressure. The patient may be confused, unable or unwilling to answer the

questions. The patient may have a complicated previous medical history with previous investigations that need to be explored. Therefore, the speed by which the information is gathered and the way in which the diagnosis was formed, can sometimes lead to physicians questioning their diagnosis:

> *Confusion on the part of patient. Past medical history, previous investigations. Yes, if ED is really busy, you take more of a triage role. If you have got more time, you think more about it. Also pressure means that you don't think through the diagnosis, for example TIA, but it is not really a TIA* [Interview P.14].

> *Obviously, I would like to spend three hours with every patient….So time is also a factor on how you diagnose a patient* [Interview P.09].

Other factors were also expressed which could impact on the gathering of information. Personal factors such as the time of day physicians were working and their level of tiredness. The lack of equipment for carrying out their physical examination of the patient, which meant that they had to search around the department to find it, which took time. This is shown in the following interview narratives:

> *Time of duty day/night. How many days in a row I've worked* [Interview P.21].

> *Time, equipment....Lack of the basics, like an auriscope or tendon hammer. Tiredness* [Interview P.13].

Senior physicians had an added time pressure. This was owing to the fact that they had to see patients, supervise the junior physicians, and undertake some departmental management issues:

> *There are pressures that are always there, time…four-hour waits…Supervision...making sure you balance everything right. In terms of the urgency of getting things done* [Interview, P.10].

A couple of physicians did state that the time pressures did not change the way they worked:

> *I don't think I change the way I work even with time pressures, I seem to keep to the way I have been taught, and perhaps I should. I am aware I am very much slower than the more senior doctors and that is probably due to the fact that I haven't developed the confidence to deviate from my relatively standardised method which I have discussed. I guess as I become more experienced I will be able to identify and focus much more quickly on what is wrong with the patient. I don't feel pressure, sometimes I am beginning to slightly, for example a dear old lady came in this morning …I nearly didn't keep to my process, but in the end I did* [Interview P.08].

> *I guess senior input, if I am lacking a diagnosis it will often come from the seniors. But I personally do not allow time issues to affect my diagnosis. I work at a rate I can work, as thoroughly as I can* [Interview P.03].

It is acknowledged that some of these factors are associated with an emergency department environment.

The lack of communication from the patient was mentioned by a couple of the physicians as being a factor which affected the way in which they diagnosed the patient:

> *Difficult if lack of communication, dementia, poor English, unconscious etc* [Interview P.19].

> *Positive factors – I think if a person has had a nursing assessment, a patient able to communicate well and can give a good history, if it is relatively easy diagnosis that's a good factor as well. Negative – not having a nursing assessment so you basically don't have any vitals to help you, plus a patient unable to communicate with you very well, plus lack of equipment that should be available but may be being used on another patient or not there at all* [Interview P.02].

> *If they already have a presumed diagnosis by another clinician before presenting to myself. Difficult if lack of communication/dementia, poor English. Unconscious etc* [Interview P.19].

Unfortunately, owing to the ethical restrictions imposed on my study; regarding my inclusion and exclusion criteria (Chapter 3.4), I was unable to observe patients who were confused or unconscious etc.

Lastly, one male physician mentioned the difference between female and male physicians' diagnostic skills, as being a factor that affected the gathering of information:

> *There is also a sex difference and age difference; the female doctors are far more insecure in their diagnosis whereas male doctors are 'gung-ho'. I think it is a difference in our neurophysiologies, research shows before they have been reconditioned by society, little girls before they go down the slide in a park they look around for their mother's facial feedback, whereas younger boys are jumping off things, so there is an innate sexual difference. Research has shown that female GPs refer into hospital more than male GPs* [Interview P.17].

I found this view particularly interesting. Firstly, 36% of the physicians were female, and I had not noticed any difference in the diagnostic process they used in comparison to male physicians. Secondly, I thought it was an unusual view. I decided to see if there was any supporting literature to substantiate this view. Arnold et al (1987) presented the following abstract at a meeting called ' Taking care of patients – does it matter whether the physician is female?

> Researchers have recently begun to compare male and female physicians' attitudes toward patients, medical knowledge, and practice styles. Although women start medical school with more "humanistic views," the conservative effect of medical socialization on both male and female students attenuates these differences. While some studies suggested that men are more scientifically knowledgeable, recent studies showed no significant differences in physicians' medical knowledge. Male and female physicians also had comparable diagnostic and therapeutic behaviour. In the intimate world of physicians and patients, however, there were notable differences. Women physicians seemed better able to communicate sensitivity and caring to patients, which may account for the common perception that women are more caring and empathic physicians. Medical educators may wish to study more closely female physicians' communication styles to identify these behaviours and inculcate (inspire) them into all physicians.

In a more recent study concerning pay differentials, Bloor et al (2007) looked at an analysis of the comparative activity rates of male and female hospital

consultants in the NHS they found that female doctors saw less patients than male doctors. However, owing to the lack of comparative information about diagnostics and patient outcomes their findings were inconclusive. It was suggested that the female consultants may have had better outcomes as they 'listen' to patients. Analysis of my data did not differentiate between male or female physicians in the way in which they undertook the medical diagnostic process. I found that male and female physicians listened to the patients in the same attentive manner.

4.5 What information is gathered by physicians during the medical diagnostic process?

As previously discussed, the medical diagnostic process is a sequence of logical steps which include gathering information through history taking; a physical examination; observations and when necessary investigations.

The basic observations used within the ED were, blood pressure, pulse, respirations and temperature. In *Majors* (see Chapter 3.1.4) these were recorded by the nursing staff prior to the physician seeing the patient and formed part of the nursing assessment. Depending on the patient's presenting complaint, other observations such as an ECG (electrocardiogram- heart trace), oxygen saturations rates and urinalysis were requested by the physician. In *Minors* (see Chapter 3,1.4) basic observations were not routinely recorded.

The basic physical examinations used within the ED were the examination of the chest and abdomen and these were carried out by the physicians. The value that the physicians placed on observations/examinations was high; 100%

of the physicians interviewed said that observations and examination were key elements of the medical diagnostic process:

> *Observations very important, I tend to look at observations first before looking at the patient...they will guide the way I take it or make an assessment of the patient, on how seriously you need to take the patient* [Interview.P.14].

> *Basic observations are important* [Interview.P.16].

> *Well, I suppose all their basic observations are generally essential, especially the majors, to tell you how well or ill a patient is* [Interview.03].

The use of medical equipment was also seen to be an important requirement to aid the medical diagnostic process. When the physicians were asked if any medical equipment/instrument influenced their clinical decision making process, their responses were very similar. The stethoscope was mentioned as a necessary piece of medical equipment for undertaking the physical examination of the patient:

> *Yes, of course it does. The stethoscope is a very obvious example you know..if someone has come in with shortness of breath I can listen to their chest..so if its clear it means it is likely not to be a pneumonia whereas crackles may indicate an infection* [Interview P.08].

> *Observations are really important. My stethoscope is obviously useful. I guess everything else are add on, the majority of times I feel that when I have finished talking to the patient I will have a good idea of what the problem is, what is going on and where they are going to go. Everything else, bloods etc, just backs it up, I find even more and more, it is less*

often that they will throw up something I wasn't expecting. Mainly it is history and examination. They are just extras, it may be something the admitting team want or may just provide proof that your diagnosis is right if you are sending them home [Interview P.18].

Yes – stethoscope /tendon hammer/observation machines – B/P/ sats /o2. Pen torch [Interview P.21].

Observations and monitoring equipment, stethoscope, pen torch, auroscope and ophthalmoscope. X- Rays. Blood gas analyser. Blood testing equipment. Thermometer [Interview P.19].

The stethoscope was seen as a piece of equipment that provided physicians with an indication of a problem such as, a heart murmur, 'noisy' chest or absent bowel sounds. These clinical findings led to physicians ordering other tests, such as ECG, Chest x-ray or abdominal x-rays using other equipment. This is shown in the following interview narratives:

A stethoscope is essential. In a way we got a lot of technology downstream. In all the med school exams they ask what type of murmur is this etc...But it is rubbish...if you hear a murmur you are going to send it to someone who will do a more advanced investigation. And for a proper neurological examination you need the right equipment. It is always on the ward, well kitted ward [Interview P.17].

All tests, some used to aid diagnosis, obviously some things such as an ECG or chest X-ray given vital information that may affect management of case [Interview.P.06].

Observations and monitoring equipment use of stethoscope, pen torch, auroscope, ophthalmoscope, X-ray, blood gas analyser, blood testing equipment and thermometer can aid diagnosis [Interview.P.14].

Yes – many – observations taken by stand alone equipment or monitors, X-rays, ultrasound, MRI (i.e. all radiology). ECGs, blood gas analyser, urinalysis, pregnancy testing, BM machines [Interview.P.11].

It was acknowledged that use of equipment was not essential for every patient:

I like a set of vitals on patients, but I do realise that it is not essential that each and every patient has to have a set, for instance the patients in minors don't need it done. It can be annoying if you haven't got it, you need essential stuff like ECGs, tests and stuff [Interview P.02].

The role that observations seem to play in influencing the physicians clinical reasoning is discussed in Chapter 5.3.4 and Chapter 6.

4.6 The value of the sequence of steps used in the medical diagnostic process.

It has now been established that the physician consenting participants valued the taught sequential steps used in the medical diagnostic process; history, physical examination, observations/investigations. Nonetheless, I found that the

steps taken and the depth of information gathered and then recorded in the patient's medical notes varied according to the patient's presenting complaint.

4.6.1 Patients' presenting complaints and the medical diagnostic step process

To explore and explain this finding, I undertook a comparative analysis (See Chapter 3.6 for detail).

4.6.2 Comparison of Groups

The distributions of presenting complaints in each group were as follows:

- Group 1 - comprised of patients with the presenting complaints of chest pain; shortness of breath; collapse, abdominal pain, PR bleed, nausea, vascular and neurological problems.
- Group 2 - comprised of patients presenting with trauma; mechanical falls; miscarriage/gynaecological problems, allergies/rashes and dental problems.

Table 4.7 and 4.8 shows the % breakdown of the presenting complaints of the patients (n.202) by groups.

Group 1	
Presenting Complaint	***Number of patients (%)***
Chest Pain	47 (23.3%)
Collapse	28 (13.9%)
Abdominal Pain	25 (12.4%)
Shortness of Breath	16 (7.9%)
PR bleeding/epistaxis	6 (3.0%)
Neurology	6 (3.0%)
Nausea? cause[20]	1 (0.5%)

Table 4.7 – Presenting Complaints in Group

[20] Nausea? Cause – this means that a patient has presented to the ED feeling like vomiting (feeling sick) and the cause is not evident.

Group 2	
Presenting Complaint	***Number of patients (%)***
Trauma	49 (24.3%)
Mechanical fall	15 (7.4%)
Threatened miscarriage/gynae	3 (1.5%)
Rash/allergy/cellulitis	4 (2.0%)
Vascular	1 (0.5%)
Dental	1 (0.5%)

Table 4.8 – Presenting Complaints in Group 2

The categories represented in Group 1, were more medically complex and therefore the cause of the presenting complaint was more uncertain, whereas in Group 2, the cause of the presenting complaint was usually determined by the injury/ailment. This is discussed in depth in Chapter 5.

4.6.3 Comparison of the profile of the patients in each group:

Sex of Patients		
	Group 1	**Group 2**
Male	83 (65%)	39 (53%)
Female	45 (35%	35 (47%)

Table 4.9 - sex of patients

Table 4.9 shows that Group 1 had a higher percentage of male patients and a lower percentage of female patients than Group 2. This finding only indicates the cases I observed. Within those cases, there was a much higher incidence of males presenting with chest pain than females and a higher incidence of females having had a mechanical fall.

The age ranges varied between the two groups. The percentage of younger patients up until the age of 45 years was noticeably higher in Group 2. This was

attributed to the fact that 57% of these patients were admitted with the presenting complaint of trauma. In Group 1, the percentage of older patients was higher. In this group the aetiology of the presenting symptoms was more uncertain and the physician was consequently looking for a causal explanation.

Age Range of Patients in Years					
	18 - 25	26 - 45	46 - 65	66 - 80	81+
Group 1	10 (7%)	29 (23%)	43 (34%)	45 (35%)	1(0.7%)
Group 2	12 (16%)	24 (32%)	16 (22%)	19 (26%)	3 (4%)

Table 4.10 – age range of patients in years. Shows the distribution of age between the two groups.

4.6.4 Comparison of the depth of information gathered/recorded during the medical diagnosis step process.

The difference between the two groups regarding the depth of information gathered/recorded during medical diagnostic step process is shown in Table 4.11. It shows that the patients in Group 1 had more information recorded in their medical notes following the clinical assessment undertaken by the physician. This finding supports the theory; the more uncertain the physician is as to the cause of the patient's presenting complaint, the more information is gathered and recorded in the medical notes.

Recorded in the Medical Notes	Group 1	Group 2
Basic Observations	82%	42%
Medical Examination	86%	49%
Blood Tests	87%	30%
Relevant Medical History	95%	61%
Chest X-ray (or requested)	40%	15%
ECG (or requested)	45%	7%
Other x-rays	12%	60%

Table 4.11- Comparison of groups of information recorded in medical notes

4.6.4.1 Relevant medical history

A relevant medical history was recorded in 95% of the medical case notes for Group 1. This finding showed the important part that a medical history played in the medical diagnostic step process, especially in cases where the cause of the illness/disease was uncertain. In Group 2, although 61% of the medical notes had a relevant medical history recorded, the history was quite brief in the majority of the cases.

4.6.4.2 Basic Observations

In Group 1, the level of the basic observations (pulse, blood pressure and respirations) were recorded in 82% of the medical notes. This illustrated the level of physician's uncertainty as to what caused the patients' presenting complaint[21]. It also indicated the importance that the physician placed on the

[21] For example, the causes of collapse can be due to arrhythmias (irregular heart beat), hypotension or hypertension (low or high blood pressure), hypoglycaemia or hyperglycaemia (low or high blood sugar), infection, fainting or other causes. In the same way,the presenting complaint short of breath, chest pain, and abdominal pain can also have a variety of causes.

observations regarding his/her clinical reasoning for him/her to transfer the information from the nursing notes into his/her medical notes (for detail see Chapter 5.3).

In comparison, basic observations were recorded in 42% of the medical notes for Group 2. This illustrates the fact that the cause of the presenting symptoms (often injuries) is determined by the injury. It is acknowledged that this is not always the case. This scenario is discussed in depth in Chapter 5.2.3.

4.6.4.3 Physical examination

The level of physical examinations recorded in the medical notes varied greatly between the two groups. Group 1 it was 86%, whereas in Group 2 it was 49%. The most common reason for this was that when a patient was admitted to the ED with an injury to a limb, the physician would start his/her examination with that limb:

> *It rather depends on what they come in with. If they come in with a simple limb problem, then you start at the limb* [Interview P.09].

However, if a patient came in with a more uncertain cause of the presenting complaint, the physician used a full physical examination to confirm or not his/her differential diagnosis:

> *Firstly, I'll go in and take a history, find out why they are here and what their complaint is. Based on their presenting complaint and a few other factors,*
>
> *age, sex, past medical history, what medication they are on, I will come up with probably a relatively short list of things that could be wrong with*

them. I'll then examine them and try to confirm or not my differential diagnosis and then it might be that I will apply a diagnostic test to that, to further refine differential diagnosis and hopefully at the end of that process come up with a definitive diagnosis [Interview P.01].

4.6.4.4 Blood tests

A much higher percentage of blood tests were recorded/requested in the medical notes for Group 1 (87%) than Group 2 (30%). This showed that the physician was looking for clues to help him/her find out the cause of a patient presenting complaint to enable the formation of an impression/working medical diagnosis. This was particularly noticeable in Group 1 where the cause of the presenting complaint was more uncertain. Many of the blood tests ordered were for routine blood tests such as a full screen; FBC (full blood count), UandEs (Urea and Electrolytes). Depending on the presenting complaint the physician used his/her biomedical/pathophysiological knowledge and training to decide on which other blood tests to request. A conclusive blood test called troponin was recorded or requested in the medical notes in 80% of the patients who presented with chest pain. This blood test was used to prove or disprove if the patient had had a heart attack. The level of troponin was measured when the patient's chest pain was > six hours prior to admission. The level of blood tests recorded/requested in the medical notes by presenting complaint category is shown in Chart 4.3.

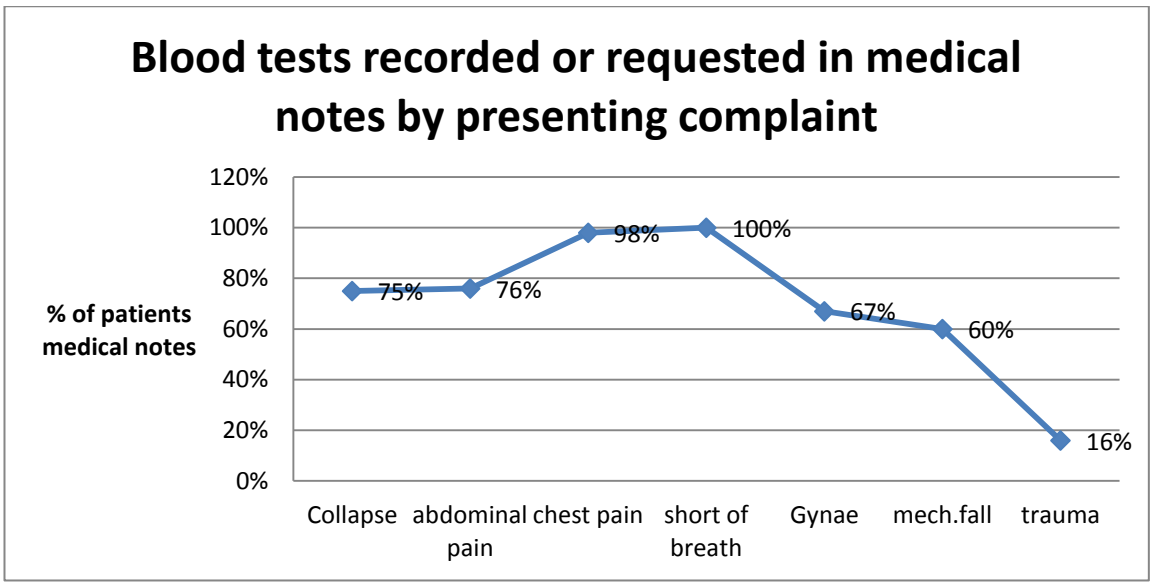


Chart 4.3 – Blood tests

4.6.4.5 ECG (Electrocardiogram – heart trace).

An ECG was recorded or requested in the medical notes for 45% of the patients in Group 1. This applied to only 4% of the patients in Group 2. The reason for this was that some of the patients in Group 1 were admitted with irregular heartbeats so the physician requested a further ECG to see what is going on or the physician through their physical examination of the patient listened to the patient's heart beat and heard a heart murmur or arrhythmia that required further investigation.

4.6.4.6 Chest x-rays

Chest x – rays were recorded in the medical notes for all categories of the presenting complaints. The ordering of chest x-rays as an investigation was based on clinical evidence following the examination of a patient's chest by the physician. A chest x-ray was recorded or requested in the medical notes for 40% of the patients in Group 1. This applied to only 15% of the patients in Group 2.

4.6.4.7 Other x-rays

The trauma and mechanical fall categories of presenting complaints had the highest incidence of other x-rays recorded in medical notes, 59% and 60% respectively. This was to be expected, as the physicians were trying to rule in or rule out a fracture of a bone.

Chart 4.4 and 4.5 shows the percentage of patients in each presenting complaint category that had x-rays recorded in their medical notes.

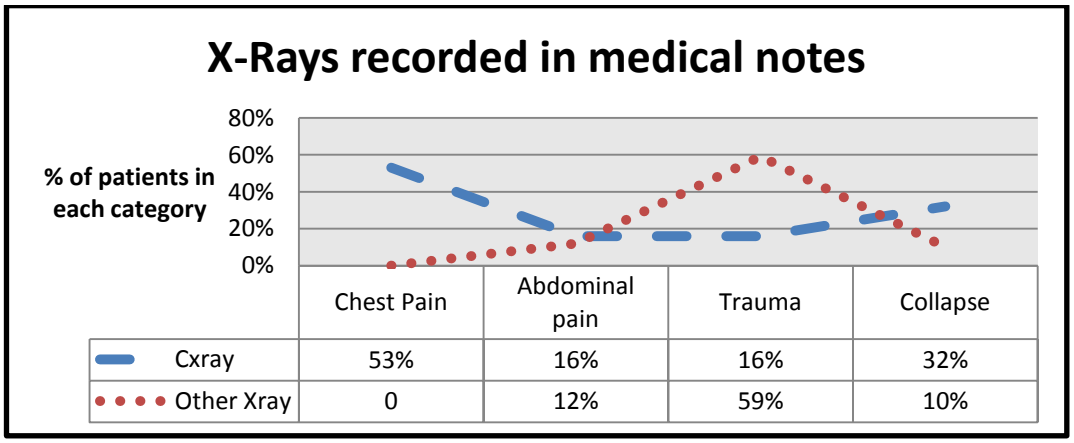


Chart 4.4- X-rays recorded in medical notes. Chest pain, abdominal pain, trauma and collapse

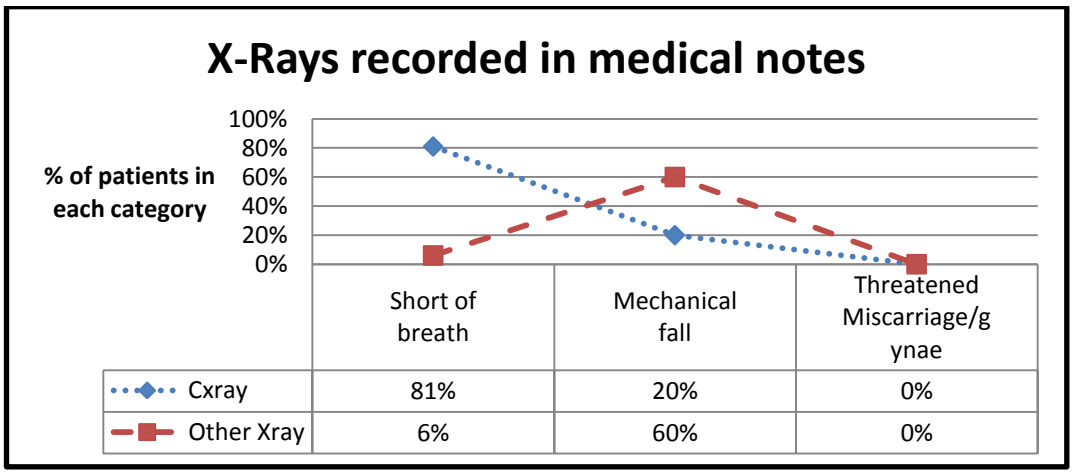


Chart 4.5 - X-Rays recorded in medical notes. Shortness of breath, mechanical fall, threatened miscarriage

4.7 Variation in the depth of information gathered and then recorded in the medical notes according to the patient's presenting complaint.

4.7.1 Findings of the cross tabulation of my data.

The findings of the cross tabulation of my data has shown that the information gathered and then recorded in the medical notes during the medical diagnostic step process did vary according to the uncertainty of the cause of the patient's presenting complaint. Previous findings (4.6.3) had indicated that patients in Group 1 had the highest level of data recorded in their medical notes regarding the medical diagnostic process. To substantiate this finding I decided to undertake further analysis using qualitative comparative crisp set analysis (QCA).

4.7.2 Findings of qualitative comparative crisp set analysis

The results of the QCA crisp set analysis showed that consistency to Group 1 was only shown in 110 patient cases out of my n-202 patient cases. This meant that 92 cases could have been in Group 1 or Group 2. Therefore my previous theory was tested and found to be neither confirmed or falsified. It was still true that the majority of patients with most information recorded in their medical notes belong in Group 1, but the analysis showed an inconsistency with some patients who could have been placed in either group. Therefore, the recorded medical diagnostic step process varied depending on the individual patient's presenting complaint and the physician's uncertainty as to the cause of that complaint. QCA had shown that the difference depended on the individuality of each patient case rather than a generalised grouping. This is shown in Tables 4.12 and 4.13.

Table 4.12 shows the cases which were consistent with Group 1. The mauve area on the table shows the cases with a consistency value of 1 and above 0.75 showing that they were consistent with Group 1. Values below 0.75 indicate substantial inconsistency. Ragin (2009: 112–115) argued that a consistency score of 0.70 is relatively low‘ or even very low‘ and recommended use of a consistency score of 0.80.

Table 4.12 - QCA output:

obsrecord	prh	bloods	exam	cxray	ecg1	number	groupa	raw consist.	PRI consist.	product
1	1	1	1	1	1	31		1	1	1
1	0	0	1	0	0	1		1	1	1
0	0	1	1	0	1	1		1	1	1
1	1	1	1	0	1	15		1	1	1
0	1	1	1	1	0	3		1	1	1
1	1	1	0	0	1	4		1	1	1
0	1	1	1	0	0	8		1	1	1
1	0	0	1	0	1	1		1	1	1
1	1	1	0	1	1	2		1	1	1
1	1	1	1	1	0	15		0.933333	0.933333	0.87
1	1	1	1	0	0	29		0.793103	0.793103	0.63
1	1	0	1	0	1	3		0.666667	0.666667	0.44
0	1	1	1	0	1	3		0.666667	0.666667	0.44
0	0	1	0	0	0	3		0.666667	0.666667	0.44
1	0	0	0	0	0	4		0.5	0.5	0.25
1	1	0	1	0	0	10		0.5	0.5	0.25
1	1	1	0	0	0	6		0.5	0.5	0.25
0	1	1	0	0	0	7		0.428571	0.428571	0.18
0	1	0	1	0	0	10		0.3	0.3	0.09
1	1	0	0	0	0	5		0.2	0.2	0.04
1	1	0	1	1	0	6		0.166667	0.166667	0.03
0	1	0	0	0	0	7		0.142857	0.142857	0.02
0	0	0	1	0	0	4		0	0	0
0	0	0	0	0	1	1		0	0	0
0	1	1	1	1	1	2		0	0	0
0	0	1	1	0	0	2		0	0	0
1	0	0	0	1	0	1		0	0	0
0	0	0	0	0	0	15		0	0	0
1	0	0	1	1	0	1		0	0	0
1	0	1	0	0	0	1		0	0	0
1	0	1	1	1	0	1		0	0	0

This table shows the number of cases displaying the combination of conditions (number) and the proportion of cases in each truth table row that display the outcome (consist). The column showing product in crisp set analysis is simply the degree of consistency squared.

Based on the consist column, where 1 shows consistency and values below 0.75 indicate substantial inconsistency, it was necessary to remove the rows that failed to meet the frequency threshold. Table 15 shows the result of further deleting and coding. The number 1 was coded to Groupa (Group1).

Table 4.13 – QCA output:

obsrecord	prh	bloods	exam	cxray	ecg1	number	groupa	raw consist.	PRI consist.	product
1	1	1	1	1	1	31	1	1	1	1
1	0	0	1	0	0	1	1	1	1	1
0	0	1	1	0	1	1	1	1	1	1
1	1	1	1	0	1	15	1	1	1	1
0	1	1	1	1	0	3	1	1	1	1
1	1	1	0	0	1	4	1	1	1	1
0	1	1	1	0	0	8	1	1	1	1
1	0	0	1	0	1	1	1	1	1	1
1	1	1	0	1	1	2	1	1	1	1
1	1	1	1	1	0	15	1	0.933333	0.933333	0.871111
1	1	1	1	0	0	29	0	0.793103	0.793103	0.629013

Table 4.14 shows that all independent variables; observations, past relevant history, blood tests, examination, chest x-ray and ECG were recorded in 31 cases. 15 cases had all independent variables except for chest x-ray. 15 cases had all independent variables except for ECG. 29 cases had all independent variables except for chest x-ray and ECG and 20 further cases showed other combinations of the independent variables consistent with being in Group 1.

This meant that only 31 cases had every independent variable present. The other rows show different combinations. Table 16 shows this distribution in the cases consistent with being in Group 1, the ticks in each box represents the presence of that independent variable recorded by the physician in the patient's medical notes.

Number of Cases	Observations	Examination	Bloods	Previous Relevant History	C X-Ray	ECG
31	✓	✓	✓	✓	✓	✓
15	✓	✓	✓	✓	✓	
15	✓	✓	✓	✓		✓
29	✓	✓	✓	✓		
3		✓	✓	✓	✓	
4	✓		✓	✓		✓
8		✓	✓	✓		
2	✓		✓	✓	✓	✓
1	✓	✓			✓	
1	✓	✓				

Table 4.14 – Independent variables recorded in medical case notes.

I found that the use of crisp set QCA allowed me to understand my data in terms of sets rather than the contribution of single variables. Ragin (1987: 3) suggests that 'while causes may be analysed in terms of variables, cases are viewed as configurations – as a combination of characteristics'. Byrne (2009) suggests that QCA allows for complex causation, where lots of things act together to generate an outcome; multiple causation where the different configurations can generate the same outcome and that it makes you think about your cases. The use of crisp set QCA helped me compare the different configurations in relation to the outcome and led me to explore and interpret the findings shown in the QCA tables. Ragin (1987:4) suggests that QCA is

interpretive work. My interpretation of the configurations showed that a case with the independent variable of observations and examination recorded could be deemed to have a consistent value of 1, to Group 1; whereas three cases with the independent variables of observations, past relevant history, examination and ECG recorded/requested could be deemed to have only 0.66 consistency to Group 1. Other contradictory configurations were found.

The Qualitative Comparison Analysis did prove that the steps recorded in the medical notes regarding the diagnostic process taken by the physicians varied according to the patient's presenting complaint. However, in this comparison I had only included observations, physical examination, tests and previous relevant medical history. I decided that it would be useful to compare the other information that had been gathered by the physician, such as prescribed drug history, social history etc.

I found that the patient's prescribed drug history was shown to be regarded as important and was recorded in 91% of the medical notes. This prescribed drug history provided information which allowed the physician to see which illnesses/conditions the patient was already receiving treatment for from their GP. The influence of this information in the physicians clinical reasoning is discussed in Chapter 5.

Table 4.15 shows the information recorded by the physicians in the patients' medical notes. The patients' social history was only recorded in 64% of the medical notes; however, these notes showed that 44% of the 35% recorded as living alone were aged 66-80 years old. This did have some bearing on patients either being discharged or admitted. The following chart shows the percentage of historical information recorded in the patients' medical notes. This data just

shows that the physician asked the patient for information and recorded their response. It does not relate to the significance of the information, as in some cases the physician just stated that the patient did not have a previous medical history or was not taking any prescribed medication. What it does show is that the physician asked the questions. The only thing it ***may*** indicate is the relevance of history taking to the physicians during their clinical reasoning depended on the patient's presenting complaint:

	Information recorded in the patients' medical notes
Social history	64% (129)
Smoking	29% (58)
Alcohol	23% (46)
Prescribed drug history	91% (183)
Past relevant history	83% (167)
Previous cardiac history	67% (136)
Diabetes	71% (144)

Table 4.15-Information recorded in the patients' medical notes. (n=202)

To understand the gathering and recording of information more fully, I undertook a comparative analysis between Group 1 and Group 2 patients. The findings are shown in Table 4.16.

	Information recorded in the patient's medical notes	**Information recorded in the patient's medical notes**
	Group 1 (n =117)	Group 2 (n=85)
Social history	85 (73%)	44 (52%)
Smoking	39 (33%)	19 (22%)
Alcohol	29 (25%)	18 (21%)
Prescribed drug	115 (98%)	68 (80%)

history		
Past relevant history	75 (64%)	29 (34%)
Previous cardiac history	101 (86%)	35 (41%)
Diabetes	102 (87%)	42 (49%)

Table 4.16 - information recorded in the medical notes by groups.

Further comparative data was undertaken looking at previous medical history. X-Rays recorded/requested in the patients' medical notes and the number of patients admitted to inpatient care.

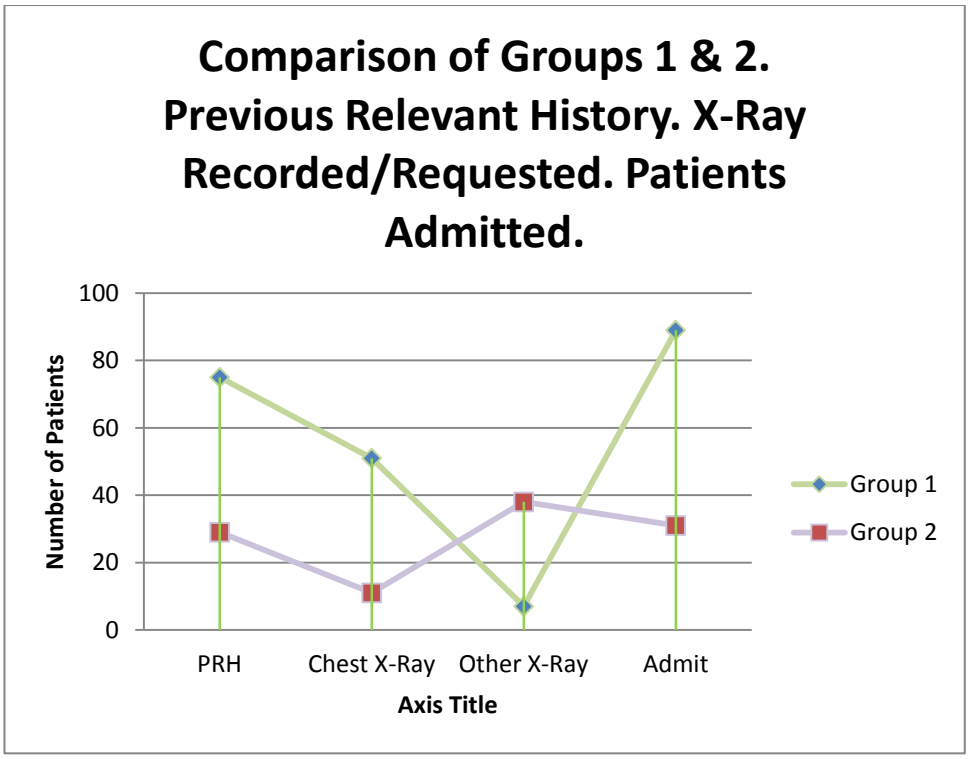


Chart 4.6 -Group 1 and Group 2 comparison of x-rays recorded/requested in medical notes, previous medical history and patients admitted to inpatient beds

By using QCA and a case-based approach, I was able to establish five important points:

1. There is an interdependence between the information gathered during the medical diagnostic step process and clinical reasoning.
2. All the patients are individual.
3. The steps in the medical diagnostic process were sequential, but did vary in depth according to each individual patient case.
4. There was an inconsistency in the gathering then recording of data for the patients in Group 1, where the cause of the presenting complaint was uncertain.
5. There was some uncertainty in the cause of the patient's presenting complaint in Group 2.

4.8. Concluding comments

The findings highlighted in this chapter show the importance that physician respondents placed on the taught sequential approach to gathering information during the medical diagnostic process. This logical approach made them feel more confident and helped them to manage the uncertainty that is inherent within medicine. Physicians understood the value of the physician/patient interaction and the role they had to play in building a rapport with the patient as quickly as possible to gain the information they required. The questioning of the patient was shown to consist of an open question followed by some standard questions, depending on the patient's presenting complaint. This questioning was based on the physician's scientific knowledge of biomedicine and pathophysiology.

Observations were seen to be essential to the medical diagnostic process. However, there was an inconsistency in their use and the information recorded in the patients' medical notes. Physicians' gathering and then recording of data for the patients varied depending on the patient's presenting complaint. This appeared to be due to the physician's uncertainty as to the cause of patient's presenting complaint in both groups, Group 1 and Group 2. These findings are explored further in Chapter 5.2.1.

A factor affecting the gathering of information mentioned by the physicians, was the pressure of time, owing to the four hour waiting time directive. Nonetheless, the physicians seemed to adapt to this pressure within the ED.

In the next chapter, Chapter 5, I have explored how the medical diagnostic step process influenced the physicians' clinical reasoning when forming his/her impression/working diagnosis. I have examined the quality or significance of the information gathered and then recorded in the medical notes. Using individual medical case-notes, taped patient /physician interactions I provide an explanation of physicians clinical reasoning when forming their medical diagnosis. In Chapter 6, the contents of Chapter 4 and 5 are discussed in depth in a more theoretical context and in relation to the findings of previous research.

Chapter 5 – Medical Diagnosis - Clinical Reasoning

5.1 Introduction

In this, the second of my data chapters, the aim is to show how physicians used clinical reasoning to identify the probable cause of a patient's presenting complaint.

In Chapter 4, I have shown that the medical diagnosis step process is concerned with gathering information. I have identified that the recording of this information in the patient's medical notes varied. This appeared to be dependent on the physicians' uncertainty as to the cause of the patient's presenting complaint. However, to understand how physicians attribute cause when forming a medical diagnosis I have explored causal conditions and how physicians use their clinical reasoning to interpret the information gathered.

I have used individual patient case-based examples to show the clinical reasoning that has been *captured* through the mixed method approach (See Chapter 3.6 for detail). I also explore the clinical reasoning of the novice and the expert and gain the views of physicians regarding how they blend clinical reasoning and evidence-based medicine in their clinical practice.

5. 2 The clinical reasoning approach

The analysis of my data suggests that clinical reasoning takes place from the moment the physician meets the patient; their first impression of how the patient looks and how the patient responds to their questions. The physician's questions are based on his/her biomedical/pathophysiological and empirical

knowledge. This was learnt at medical school and is built on throughout their careers through their clinical experiences. The physical examination of the patient, observations and subsequent investigations are used to rule in or rule out the physician's initial thoughts; the differential diagnosis.

As established in Chapter 4.4.2 physicians base their questions on the patient's presenting complaint; on their signs and symptoms. I suggest that it is these signs and symptoms which indicate that something abnormal is occurring in relation to the body's normal functioning, for example; a fever and a rash or pain. These causal conditions lead physicians to their first thoughts of a probable diagnosis.

I have shown in Chapter 4, that the medical diagnostic process is a taught process of sequential steps. These steps taken by physicians were a process of gathering information on which to form an impression or working diagnosis of what they thought was medically wrong with the patient. I have shown that the steps varied in the depth of information gathered/recorded according to the patient's presenting complaint. Simply put, the more uncertainty in the cause of the patient's presenting complaint the more information was gathered /recorded. I now focus on the clinical reasoning undertaken by physicians during my study.

5. 2.1 The patient cases

To demonstrate the interdependency of the steps utilised in the medical diagnostic process and the clinical reasoning approach taken by physicians, I have used some examples of individual patient cases. These cases have been selected to show where the cause of the patient's presenting complaint was uncertain compared to cases where the cause of the patient's injury/ailment

was determined. I have also included a couple of examples of cases that I felt combined the two categories.

5. 2.1.1 Uncertain cases

The following cases are examples of patients who presented to the ED complaining of the presenting complaints; chest pain, shortness of breath, collapse, and abdominal pain. The cause of their presenting complaints was uncertain, so the physicians used their clinical reasoning skills to decide on a probable diagnosis. In each case, the physician introduced himself/herself to the patient and then gained the patient's history. The recorded narratives of the physician/patient interactions and subsequent written medical notes are shown below. For each individual case I have provided my interpretation of the clinical reasoning that appeared to take place and discuss its rationale.

Case 1: Presenting Complaint – chest pain

Physician: *Can you tell me what is wrong?*

Patient: *Chest pain*

Physician: *How long?*

Patient: *Couple of days ago*

Physician*: When is it worse?*

Patient: *When I wake up, I can't go to sleep again*

Physician: *Because of the pain?*

Patient: *No, not because of the pain, because I can't go to sleep again.*

Physician: *The pain doesn't keep you awake?*

Patient: *No, I go to the toilet and get a lot of wind*

Physician: *0k. So how many days ago did the pain start?*

Patient: *0h 2 or 3 days, on and off, like*

Physician: *Is it a sharp pain or a dull pain?*

Patient: *Dull pain really*

Physician: *A dull pain, and when it is there how bad a pain is it? Out of 10?*

Patient: *6 really, it not there now,*

Physician: *So it's gone, when it was there, how long did it last for?*

Patient: *About 10 minutes, it is not there when I rest it is when I get up really.*

Physician: *And when it's there do you have to sit down or do you keep on going?*

Patient: *I keep on going.*

Physician: *You don't clutch your chest and sit down?*

Patient: *No*

Physician: *Have you had anything like his before?*

Patient: *About 6 weeks ago I had two injections in my shoulder*

(Patient examined by physician, reflexes and sensation in limbs).

Physician: *Is your arm always difficult to lift because of your shoulder?*

Patient: *Yes*

Physician: *Do you get short of breath when you walk upstairs?*

Patient: *No*

Physician: *Any pain?*

Patient: *No*

Physician: *I'll just listen to your heart and lungs* (Physician listens to patient's chest)

Physician: *I don't think this pain is your heart. I think this pain is related to your shoulder, you have a lot of muscle spasm. Did the nurse take some bloods?*

What it is, is that we have a blood test that is very specific to your heart and as your pain was at least 12 hours ago we can see if your heart has been damaged in any way. If it comes back negative we can say it is not your heart and probably due to your shoulder. Your heart trace was ok; I don't think we need to do a chest x-ray. If your bloods are ok to can go home, it is very unlikely to be your heart, but your shoulder [P03/09. M.79].

This narrative shows that the physician asked questions regarding the patient's signs and symptoms of his chest pain. In particular, these questions related to the type of chest pain, its duration and whether the patient had any other symptoms, associated with the chest pain, for example; shortness of breath. The answers given by the patient did not conform to the classical pattern of cardiac chest pain. These are commonly thought to be; tight central chest pain associated with a shortness of breath and sweating. The clinical reasoning used by the physician led him to the impression that the patient's condition was not cardiac[22], but probably due to a shoulder problem.

In the medical notes written by the physician following his medical assessment, the physician recorded that the patient had previously had a frozen shoulder. I

[22] Cardiac – related to the heart.

suggest that this information influenced his clinical reasoning. Fortunately, owing to the fact that the patient had presented with chest pain, a conclusive blood test (Troponin[23]) had been requested (according to protocol) to rule in or rule out that if the patient had had a heart attack.

The physician returned to the patient and explained that the blood test was positive.

> Physician to the patient: *I'm afraid the blood test we took, the heart one, is raised, so we are going to have to admit you, to get our medical colleagues to see you.*

The impression/working diagnosis made by the physician was Probable Myocardial Infarction *(heart attack).*

Documentary Evidence – Medical Notes	
Patient's presenting complaint:	Chest Pain.
Patient's history:	2-3 days intermediate dull left sided chest pain lasts 5 minutes every hour or so. Worse pain was 18.00 hrs last night, currently pain free.
Past Medical History:	Frozen shoulder.
On Examination:	Comfortable. Observations as charted, chest clear. ECG sinus bradycardia[24]. Left shoulder pain.
Plan:	Blood test - increased TROP. Admit.
Impression/working diagnosis:	Probable Myocardial Infarction[25]

[23] Troponin – blood test taken to measure protein released in a heart attack.
[24] Bradycardia – slow heart beat.
[25] Myorcardial infarction – heart attack.

Case 2: Presenting Complaint – chest pain

This patient presented to the ED with chest pain, the physician asked the same type of questions as shown in Case 1, these were questions regarding the patient's signs and symptoms of his chest pain. In particular the type of chest pain, its duration, radiation and whether the patient had any other symptoms. In this case, the signs and symptoms appeared to fit with the classical pattern usually seen in cardiac (heart) chest pain and this lead the physician to the probability of a cardiac problem. There were other factors present that could have influenced the physician's clinical reasoning, such as; the patient's family history which was significant, as many members of his family had had heart attacks.

Physician: *What is happening?*

Patient: *I was having really bad pains across my chest, I couldn't breathe properly. I tried to like take deep breaths to get rid of it, but I couldn't, so I got out of bed and nearly passed out. I managed to get to the landing, stood there for about five minutes, felt I was going to faint at any time. I then felt better, got my breath back, laid on the bed and fell asleep. And then this morning, when my wife woke up, I told her, she went mental and rang the doctor, and he told her to bring me up here, which I thought was a bit over the top.*

Physician: *Ok*

Patient: *I now I am waiting... Because I want to go home.*

Physician: *OK...so where is the pain?*

Patient: *Right on this side of my chest.*

Physician: *Where did it go?*

Patient: *Right across, I just couldn't breath*

Physician: *So it was tight?*

Patient: *Yeh... really bad.*

Physician: *Didn't go up into your neck?*

Patient: *No, I just felt all tingly.*

Physician: *Ever had anything like this before?*

Patient: *Yes, and they kept me in for 4 days, I don't want to stay in again.*

Physician: *So you were asleep and it woke you up?*

Patient: *Yes.*

Physician: *Any positions made it better or worse? You said you were sweating?*

Patient: *Yeh...felt sick* [P04/22.M.51].

Following this interaction with the patient, the physician examined the patient. On examination of the abdomen, the patient complained of epigastric[26] pain and when the physician examined the patient's chest, she heard some basal crackles[27] and the patient complained of tenderness over his ribs. Owing to this other information, the physician faced some uncertainty regarding her diagnosis, therefore her clinical reasoning suggested a number of possibilities, these appeared to be based on her biomedical/pathophysiological knowledge related to the signs and symptoms she had found, these were; acute cardiac syndrome, gastritis[28], pulmonary embolism[29], pericarditis[30].

[26] Epigastric – upper .abdomen.
[27] Crackles – noises in the lung.
[28] Gastritis – inflammation of the stomach.
[29] Pulmonary embolism – clot of blood in the lung.
[30] Pericarditis – inflammation of the outer lining of the heart.

The next step taken by the physician was a process of elimination through tests and investigations. She ordered a chest x-ray to examine the lungs and requested the conclusive blood test (troponin-TROP) to prove or disprove a heart attack.

The TROP came back negative and owing to the fact that the patient's first bout of chest pain was > 6hours before. This proved that the patient had not had a heart attack. The patient was admitted for further tests.

In this case, the examination of the patient played a significant part in the final differential diagnosis. Further investigations were necessary to rule in or rule out each condition therefore the medical diagnosis remained uncertain. Only the use of deterministic reasoning through the conclusive troponin blood test could rule out that the patient had not had a heart attack. The medical notes below show the documentary evidence for this case:

Documentary Evidence – Medical Notes	
Presenting Complaint:	Chest pain
History Presenting Complaint:	Pain awoke him from sleep at 0100am - 9/10 central, band like. Lasted 5 – 10 minutes. Associated SOB++, sweating, no nausea or vomiting. Did not radiate to jaw /arms. Pain still present this morning 1-2/10, central and worse sitting forward, worse on inspiration, vomited once.
Family History:	Brother 52 – triple bypass, sister, brother, father – Myocardial Infarctions.
Social History:	Lives with wife. Independent, fit and well. Never smoked. Alcohol - 4 to 5 pints/week.
Previous Medical History:	Previous admission 3 years ago – chest pain. Not MI – ECG – normal. No history of indigestion /reflux.
Drug History:	NKDA [31] Nil regularly.
On Examination	Dizzy on standing. No fever/cough/sputum/diarrhoea/dysuria recently. Respiratory rate18.Stats 94% on air. Pulse 73 regular .no radial to radial delay. B/P 139/93. T 36.7 JVP not raised. Bi basal crackles. Tender over ribs overlying heart. Tender epigastric and LIF Now 1-2/10 chest pain.
Impression/working diagnosis:	Chest pain. - need to rule out Acute Cardiac Syndrome -?gastritis - ?pericarditis - ?PE
Plan :	Await TROP. D/W senior. CX-Ray. TROP came back less than 3. Admit.

These first two cases show the uniqueness of each patient and how signs and symptoms displayed by patients can be misleading. The clinical reasoning used

[31] NKDA - no known drug allergies.

by the two physicians involved showed that they both used the same type of questioning to gain their patient's history. Initially, this led them to different impressions/working diagnoses.

The next two cases are examples of two patients who presented to the ED complaining of shortness of breath.

Case 3: Presenting Complaint – shortness of breath

The physician introduced himself to the patient and then gained the patient's history. The questioning followed the same pattern as the previous cases; establishing the signs and symptoms.

Physician: *Shortness of breath and chest pain, is that right?*

Patient: *Yes.*

Physician: *Can you tell me when it started?*

Patient: *Yesterday afternoon, uncomfortable, worse through the night*

Physician: *Where was the pain? (Patient pointed to 3rd rib, right side of chest)*

Patient: *Going around to the back.*

Physician: *Are you coughing anything up?*

Patient: *Yes.*

Physician: *Is it white?*

Patient: *No, yellow.*

Physician: *I see you have been diagnosed with a clot on the leg recently is that right?*

Patient: *Yes.*

Physician: *Why do they think that you developed that clot, any reason given?*

Patient: *I was driving 11 hours a day, so sitting down* [P03/ 20. M.54.M].The physician then examined the patient.

In this case, the physician asked the usual question regarding the patient's shortness of breath and chest pain. The patient had had a recent history of having a deep vein thrombosis[32]. This led the physician, based on his biomedical/pathophysiological knowledge, to reason that the shortness of breath and chest pain could be related to a clot of blood. The clot of blood may have broken off from the original clot of blood in the leg and gone to the lung, causing a pulmonary embolism . In the subsequent medical notes the physician noted that the patient was receiving anticoagulant[33] medication, which could have an impact on his differential diagnosis *(If the blood had been thinned properly, there was less likelihood of a clot forming).*

Another factor which seemed to influence his clinical reasoning was that the patient was coughing up yellow sputum; meaning that the patient could have an infection in his lungs. However, the patient's observations indicated that he did not have a fever, as his temperature was 36.9˚C.[34] When the physician clinically examined the patient's chest, he heard crackles, indicating that the patient could have a chest infection. Therefore, his differential diagnosis was a pulmonary embolism or pneumonia[35]

[32] DVT Deep vein thrombosis - Clot of blood in the calve
[33] Anticoagulant - blood thinning.
[34] Normal temperature - 37˚C
[35] Pneumonia - infection in the lung.

The physician ordered a chest x-ray to rule out an infection and a blood test called an INR to check the clotting time of the patient's blood. If the normal time taken for blood to clot proved prolonged, this test could rule out the probability of a pulmonary embolism.

Documentary Evidence – Medical Notes	
Presenting Complaint :	Pleuritic chest pain + Shortness of breath
History Presenting Complaint :	Diagnosed DVT on Tuesday commenced on clexane and warfarin[36]. Last night developed right sided pleuritic chest pain radiating around the back, worse on aspiration but present all the time. Has had a cough and cold for a few days – yellowish sputum. No fever.
Past Medical History:	Recent diagnosis DVT. On Warfarin Tuesday and Wednesday. Clexane 150mgs Mon, Tuesday, Wednesday.
Social History:	Farmer – non smoker
On Examination:	looks well, not dyspnoeic[37] RR 20. P.91 Sats 97% 2 litres O2. B/P 153/106. T 36.9. ECG SR. Chest crackles. Left calve swollen – non tender.
Impression/working diagnosis :	1. Pulmonary Embolism 2. Pneumonia with muscular pain.
Plan	Bloods including .INR Chest X-Ray. Discuss with medical registrar, with results.

[36] Warfarin – blood thinning drug.
[37] Dyspnoeic - difficulty in breathing.

Case 4: Presenting Complaint – shortness of breath

This patient presented to the ED complaining of shortness of breath. The patient was known to have a chronic lung disease. The physician's questioning took the form of finding out how the patient was managing her disease and if the signs and symptoms she was complaining of, were due to her chronic condition or some other medical problem. The patient had a high temperature, which could have been caused by an acute on chronic episode with her Chronic Obstructive Pulmonary Disease, such as a chest infection. The physician asked the patient if she had any other problems, and discovered that the patient had a urine infection. In these cases of chronic illness, it was important that the physician did not just assume that the chronic condition was the cause of the problem. This case was a good example of the taught logical steps of the medical diagnostic process, which avoided the physician missing any salient clues (Chapter 2, Section 4). The recorded narrative that took place between the physician and the patient showed how important it was for the physician to ask the right questions.

Physician: *Do you have any medical problems?*

Patient: *No, only this one.*

Physician: *Which is?*

Patient: *Difficulty in breathing.*

Physician: *Do you still smoke?*

Patient: *When I say I don't, I still do sometimes. My husband died tragically, well he hung himself so now and again I have a bad day, I get my ups and downs and I automatically reach for a cigarette. So*

Christmas Day was the last time I had one. So it's a case of too late now the damage is done.

Physician: *Well no... Every cigarette makes the damage worst.*

Patient: *But like I say 60 years ago everybody smoked, in restaurants, cinemas, hospitals.*

Physician: *Now, you are not on any home oxygen are you?*

Patient: *No.*

Physician: *Are you on nebulizers?*

Patient: *No, I was, a friend had a spare nebuliser and one of the doctors gave me some capsules to put in, but when I went up to the Devon doctors on Monday, she said I mustn't do that, mustn't have them.*

Physician: *Why?*

Patient: *I don't know darling. Apparently this nebuliser wasn't for me, it was a friend's.*

Physician: *Well no, you shouldn't take your friend's medication.*

Patient: *It was my medication it was her nebuliser.*

Physician: *So, you were sharing her machine?*

Patient: *No, I wasn't sharing it, she gave it to me.*

Physician: *So no nebuliser? When did you last use that nebuliser?*

Patient: *Not sure, I ran out of capsules.*

Physician: *So how do you usually get around?*

Patient: *I don't, my neighbour gets me a loaf of bread, shopping etc.*

Physician: *So you are housebound?*

Patient: *I'm frightened you see, and I get shaky.*

Physician: *No recent hospital admissions, is that right?*

Patient: *Three years ago.*

Nurse: *DVT three years ago.*

Patient: *And I had to come in for me chest.*

Physician: *So what has being going on recently?*

Patient: *I haven't been right for a couple of years really, but I have managed to cope with it, with my inhalers. But I have had a bit of a head cold so I took some paracetamols, stayed warm and drank plenty of fluids.*

Physician: *A head cold, when?*

Patient: *Friday. On Saturday I got out of bed and I was almost on my knees.*

Physician: *Due to?*

Patient: *My breathing. It was new Years day so I thought it was no good me phoning anyone.*

Physician: *So when you say head cold, do you mean snotty nose?*

Patient: *I did have… like a blocked sinus.*

Physician: *And you have been short of breath?*

Patient: *Yes, and all I've got is my puffers.*

Physician: *Any antibiotics? When you saw your GP.*

Patient: *Yes, Monday.*

Physician: *So you've got the shortness of breath which keeps you in. Are you coughing at all?*

Patient: *No not really.*

Physician: *Anything else?*

Patient : *No, not really, although my water is very strong and little bit smelly, odorous.*

Physician: *Does it hurt to pee?*

Patient: *No, but I have been wearing these Tena Ladies, as it is staining my pants.*

Physician: *Is that usual for you?*

Patient: *No, I also have a deep ache down here (patient points to lower abdomen).*

Physician: *Do you have any other medical problems?*

Patient: *Like what, darling?*

Physician: *Any operations? Do you take any medications? Are you allergic to anything?*

Patient: *Yes penicillin.*

Physician: *What happens when you take it?*

Patient: *I took one about lunchtime and I started itching all over. Then all of a sudden I started shaking.*

Physician: *Any other medication?*

Patient: *Doctor gave me this new inhaler this morning, but I don't know how to use it* [P14/44.F.76]. The physician then examined the patient.

The patient's medical notes recorded by the physician following this assessment, showed that the examination and observation of the patient played an important part in physician's clinical reasoning leading to him forming an impression/working diagnosis. The patient had a high temperature, which was an indication of an infection somewhere in the body. The sign of offensive urine and discomfort in the lower abdomen indicated that the patient probably had a urinary tract infection. This diagnosis was confirmed by a positive urine test. The physician formed the impression/working diagnosis of a urinary tract infection.

Documentary Evidence – Medical Notes	
Presenting complaint	Shortness of breath
History of Presenting Complaint	Unwell 6/7 – initially 5/7 more SOB, mild, non productive cough. No other respiratory problems –
Past medical History	COPD, still smokes occasionally. No home O^2. No nebulisers House bound – no recent hospital admissions. DVT 2yrs ago.
On Examination:	Talking in full sentences. Purse lip breathing. RR32. Sats 98%on 2L. HR 91. B/P 157/89. T37.8.Offensive urine + wearing Tena Lady and discomfort – lower abdomen. Urinalysis positive.
Drug History	Seretide (newpack inhaler) patient not aware how to use it.
Social History	lives alone, coping with help from neighbour
Impression/working diagnosis:	Urinary Tract Infection
Plan	Admit. Antibiotics

The next two cases show further examples of patients with uncertain causes of their illness/disease; one had the presenting complaint of abdominal pain and one was admitted to the ED with palpitations.

Case 5: Presenting complaint - abdominal pain.

The physician introduced himself(sic)to the patient and then gained the patient's history. The questioning followed the same pattern as the previous cases; establishing the patient's signs and symptoms.

Physician: *So you have had some stomach pain, when did that start?*

Patient: *For about three weeks, getting worse. So I went to the doctor, he said it could be irritable bowel syndrome, and gave me some pain killers.*

Physician: *So this has been going on for a few weeks this tummy pain, so has it been there all the time, or does it come and go?*

Patient: *Off and on.*

Physician: *So it has been off and on for three weeks and you went to see your GP. When was that?*

Patient: *A couple of days ago.*

Physician: *Ok, and how many times have you seen your GP in that three weeks period?*

Patient: *Three times.*

Physician: *Did they do any tests? Ultrasound? Blood tests? X-rays*

Patient: *No.*

Physician: *Ok and what tablets have they started you on?*

Patient tells the physician.

Physician: *And are you usually fit and well? And what is this about you may be pregnant? Have you had a positive pregnancy test?*

Patient: *I did a test that was positive.*

Physician: *Did the GP do a pregnancy test on you?*

Patient: *No.*

Physician: *And where is it most sore in your tummy?*

Patient points to the bottom of her abdomen.

Physician: *So all across the bottom of your tummy? Have you had any trouble with vaginal bleeding or discharge?*

Patient: *Yes.*

Physician: *So you have had some vaginal bleeding as well. As that been less or more than a normal period?*

Patient: *About the same.*

Physician: *Any clots?*

Patient: *No clots.*

Physician: *And have you had your bowels open normally?*

Patient: *Yes.*

Physician: *Have we had a urine sample from you today?*

Patient: *No.*

Physician: *When was your last period?*

Patient: *The end of last month* [P.12/P.34.F.37].The physician then examined the patient.

In this case, the physician gained the patient's story, establishing where her pain was, its duration etc. As the pain was in the lower abdomen, the physician asked more questions relating to the patient's bowel and bladder function. The physician noted that a previous diagnosis of irritable bowel syndrome had been made by the GP and treatment had been commenced. The patient confirmed that she has had her bowels open normally. The physician asked the patient for a specimen of her urine to test for infection or any abnormality with the bladder. As the patient was female and of childbearing age, the physician focused on the fact that the cause of the abdominal pain could be a complication of pregnancy. A pregnancy test was requested and that tested positive, so the patient was referred to a Gynaecology ward with an impression/ working diagnosis of suspected Ectopic pregnancy.

Documentary Evidence – Medical Notes	
Presenting complaint	Abdominal pain
History of Presenting Complaint	3/52 history intermittent abdominal pain with vomiting in mornings. Sharp 10/10 Seen by GP – Diagnosis ? IBS[38] Given co –codamol, mebevrine. Worsening. PV bleeding. (L) normal period. Bowels √ states constipated. States could be pregnant. Confused as to whether had positive or negative pregnancy test.
On Examination:	B/P 130/84 HS normal. abdomen soft, tender, lower abdo ++ guarding ABS
Impression/working diagnosis:	?Ectopic pregnancy
Plan:	IVI/ pregnancy test/bloods – refer to gynaecology
Result	Pregnancy test – positive – refer to gynaecology.

Case 6: Presenting complaint - palpitations.

The physician introduced himself to the patient and then gained the patient's history. The questioning followed the same pattern as the previous cases; establishing the patient's signs and symptoms.

Physician: *So how are you feeling at the moment?*

Patient: *I feel a lot better, better than I have done for a while, slowed down again.*

[38] IBS - irritable bowel syndrome.

Physician: *Tell me what symptoms you have had and when they started? Start from the beginning.*

Patient: *Well, I have had these flutters and things and missed beats for the last couple of years, a few episodes that have gone away rather quickly. Two years ago, I came in to have checks, the doctor sent me in to have checks to find out what it was. But, I had all the checks, the treadmill all the rest of it. Nothing wrong, you know, so I didn't worry about it.*

This time it woke me up on Sunday night, it was banging away, so I went downstairs, and I have got my own little blood pressure monitor that goes on my wrist, because I am on blood pressure medication, so I put that on and it 132 pulse rate, blood pressure wasn't too bad, so I pottered about for a while and then went back to bed to sleep, and I managed to in the end. When I woke up in the morning it was still banging so I thought I better go to the doctors, so I went to the doctors and he said it was 104, blood pressure was alright. So all I could think of was that I have been a bit tense lately, biting my nails down again for no apparent reason.

Physician: *So making you feel a bit tense?*

Patient: *Yes, I have no reason to be tense, so she said I will try you on this medication for anxiety, so gave me this and said if you have any side effects stop taking it,? Sitolol it was called, anyway I took one tablet and later on in the evening my blood pressure plummeted right down, so I read the side effects for this drug and stopped taking it.*

Physician: *Sotalol? Is that what it was called?*

Patient: *Could have been...so I stopped taking it and then went to bed at night, managed to get to sleep alright...woke up next morning it was*

there again. It has been like that ever since. This morning was even worse, beats much stronger, that is why I came in here, now it has gone away again.

Physician: *Any pain in your chest?*

Patient: *No.*

Physician: *Blackout or unconsciousness?*

Patient: *No just dizziness.*

Physician: *And how long does that last for, minutes?*

Patient: *No, I was picking my grandson up and felt dizzy and sat down.*

Physician: *Any coughs and colds, chest infection... Anything like that?*

Patient: *No.*

Physician: *Are you well otherwise?*

Patient: *Yes.*

Physician: *Bowels Ok, waterworks ok?*

Patient: *Yes.*

Physician: *No fevers or anything?*

Patient: *No.*

Physician: *Do you smoke?*

Patient: *No, gave up thirty years ago.*

Physician: *Do you drink much alcohol? How many units?*

Patient: *I suppose I could have a couple of glasses of wine of an evening, I share a bottle with the wife.*

Physician: *Do you feel any worse with alcohol?*

Patient: *Yes, sometimes.*

Physician: *Any heart attacks, strokes, diabetes etc in the past?*

Patient: *No.*

Physician: *Any family history?*

Patient: *My mother and father both had bypasses in their 60s but they both smoked in the 60s* [P.13/33.M.65]. Physician then fully examined the patient.

In this case, the physician asked questions searching for a clue as to what had caused the patient to have palpitations. His clinical reasoning appeared to take him through questions regarding the different systems of the body, cardiac, respiratory, digestive, urinary etc. The physician noted a recent change in medication regarding the commencement of a tablet to control blood pressure. The patient's observations were noted and the physician formed an impression that the working diagnosis was atrial fibrillation.[39] The patient had a previous history of this complaint. Patient therefore admitted for further tests:

Documentary Evidence – Medical Notes	
Presenting complaint	Palpitations
History of Presenting Complaint	: fast heart beat for 3-4/7 Saw GP 3/7 ago, gave a tablet ??sotalol Patient noticed B/P drop, so stopped taking it. Today palpitations felt stronger am with brief episode of dizziness +clamminess (again no SOB/CP/syncope). Previous episode with palpitations 2 years ago – arrhythmias never caught on ECG. Exercise tolerance Test – NAD. Palpitations sometimes caused by alcohol.
On Examination:	No SOB. No syncope. Vital signs – alert and orientated. HS 1 -11 +0. HR – 96 reg. B/P 110/75. Apyrexial. Chest clear. RR. 18 Sats 98% on air.
Impression/working diagnosis:	Atrial flutter.
Plan:	*:* IV access/bloods/ECG/C-x-ray/lying andstanding B/P/Urine dip/ admit for further tests.

[39] Atrial fibrillation - fast irregular heart beat

The narratives from the last six cases have shown how the physicians have used, in each case, a range of clinical reasoning approaches; pattern recognition, hypothetic-deductive reasoning, probabilistic, causal and deterministic reasoning and forward and backward reasoning (Chapter 2.4.1.5). The cause of the patient's presenting complaints were uncertain, therefore, the physicians used a process of asking the patients questions about their signs and symptoms. The physician/patient narratives showed how the physicians delved into the information gathered looking for clues which informed their diagnosis. Their initial clinical reasoning led them to forming a differential diagnosis and that led them to deciding on which tests or investigations to do. In some of the cases it was this test or investigations that ruled in or ruled out a probable diagnosis.

5. 2.1.2 Determined cases

The following cases are examples of patients who presented to the ED complaining of the presenting complaints; trauma, mechanical fall and other minor ailments. In contrast to the last six uncertain cases, these patients present to the ED with complaints that appear to have an obvious cause. Therefore the diagnosis was determined by the injury or ailment. These cases showed a much shorter narrative between the physician and the patient when gaining the patients' history and showed that the physician tended to focus on the localised area of the injury/complaint.

Case 1: Presenting Complaint – needle stick injury

This patient presented to the ED complaining of having a needle stick injury. The physician introduced himself to the patient and then gained the patient's history:

Physician: *Can you tell me what happened?*

Patient: *I was taking a skin sample from a child using a green needle, it slipped and stuck in my finger through my glove, drew blood.*

Physician: *Are you usually well?*

Patient: *Yes.*

Physician: *Are you on any medication?*

Patient: *Only the pill.*

Physician: *Was the child high risk?*

Patient: *No, low* [P.01/P.04.F.30].

Documentary Evidence – Medical Notes	
Presenting complaint	Needle stick injury
History of Presenting Complaint	Explanation of what happened.
Past medical History	No past med history.
On Examination:	small mark on left index finger.
Impression/working diagnosis:	needle stick injury.
Plan	Follow needle stick injury protocol.

In this case, very little history was recorded in the patient's medical notes by the physician. Basic observations were not recorded and the physical examination

focused on the local area of the injury. The diagnosis was determined by the injury.

Case 2: Presenting Complaint - ankle injury.

The physician introduced himself to the patient and then gained the patient's history:

Physician: *Can you tell me what happened?*

Patient: *Jumped down from tractor hurt ankle.*

Physician: *So you turned it?*

Patient: *Not sure, pain on both sides like, stabbing pain.*

Physician: *Were you able to walk on it right after?*

Patient: *Yes.*

Wife to husband: *You were hobbling though.*

Physician: *You were able to put some weight through it?*

Patient: *Yes. (Wife commented : still hobbling though).*

Physician: *OK, any other medical problems?*

Patient: *No.*

Physician: *Broken any other bones?, on regular medication?*

Patient: *No.*

Physician examined patient's ankle.

Physician: Where is it most painful?

Patient: On the outside. Have you seen the x –ray?

Physician: Yes I have seen the x-ray, doesn't look broken, where you are tender is where all the soft tissues are. The fact that you were able to put any weight on it means that it was unlikely that it was fractured

[P.03/P16. M.37].

Documentary Evidence – Medical Notes	
Presenting complaint	R ankle pain.
History of Presenting Complaint	jumped from tractor yesterday – 4 ft, can't remember if inverted or everted foot. Immediate pain but able to weight bear. Still weight bearing but increased pain.
Past medical History	Nil.
On Examination:	R foot. Swollen ankle to left malleolus +bruises. Complained of pain on palpation posterior edges of malleoli.
Drug History	Nil.
Social History	Lives with wife.
Impression/working diagnosis:	Injury right ankle. No fracture.
Plan	Discharge.

In this case, very little history is recorded in the patient's medical notes by the physician. Basic observations were not recorded and the physical examination focused on the local area of the injury. The diagnosis was determined by the injury and confirmed by the subsequent x-ray.

Case 3: Presenting Complaint-injury to hand

The physician introduced himself to the patient and then gained the patient's history:

Physician: *You did this yesterday, didn't want to come in then?*

Patient: *Well, I use to work on building sites and half the time the first aid box would be empty, so I just wrapped it up. Now this is playing up (pointed to dislocated finger) and this has turned blue (pointed to thumb) and this keeps weeping (pointing to wound on hand).*

Physician examined patient's hand [P.03/P.19. M.52].

Documentary Evidence – Medical Notes	
Presenting complaint	25 cm wound base of index finger.
History of Presenting Complaint	Fell on ice.
Social History	Alcohol dependence.
Impression/working diagnosis:	X – Ray shows dislocation.
Plan	Refer to plastics for reduction and wound treatment.

In this case, very little history is recorded in the patient's medical notes by the physician. Basic observations were not recorded and the physical examination focused on the local area of the injury. The diagnosis was determined by the injury.

Case 4: Presenting Complaint – painful knees

The physician introduced himself to the patient and then gained the patient's history. During the questioning that took place, the physician concentrated on the patient's presenting complaint, painful knees. He examined the patient's knees and was concerned about the fluid on one of the patient's knees, therefore ordered a new x-ray. This confirmed diagnosis of+++ degenerative changes, which was what the physician had already determined:

Physician: *So you have painful knees, can you bend this one up?*

Patient: *Not much.*(Physician bends patient's leg)

Physician: *Good can you straighten your leg out? Good.*

Physician: *You have a bit of fluid on knees. As it been like this for a while?*

Son to physician: *GP tried to get some fluid out but couldn't get any at all.*

Physician: *The fluid isn't the result of you falling today?*

Patient: *No.*

Physician examined the patient.

Physician: *I think the best thing we can do is to get some new X-rays today* [P.01/P.01.M.85].

Documentary Evidence – Medical Notes	
Presenting complaint	Bilateral knee pain.
History of Presenting Complaint	Injury to right knee 18/10 when picking up a plant pot. X-ray showed no fracture. Since then weight bearing. Worsening pain in right knee.
Past medical History	AF – warfarin. Prev. Gout.
On Examination:	R knee, 80degree flexion. Effusion + patella tap. Ligament ok. Left knee 100degree flexion, small effusion.
Drug History	Lots*(not transcribed).*
Impression/working diagnosis:	X-ray – no visible changes therefore diagnosis +++degenerative changes.
Plan	Discharge.

In this case, the history was recorded in a similar way to the cases where the cause of the presenting complaint was uncertain. Basic observations were not recorded and the physical examination focused on the local area of the complaint. The diagnosis was determined by the localised swelling of the knee and the patient's pain and was confirmed by the subsequent x-ray.

These last four cases have shown that the clinical reasoning process was less complicated than in the previous six cases where the cause of the patients' condition was uncertain. In these determined cases, the physicians were seen to use causal and deterministic reasoning (Chapter 2.4.1.9).The cause of the injury/complaint was apparent and therefore the diagnosis was determined.

5.2.1.3 Uncertain/determined cases

As established in Chapter 4.7 although patients can be placed in categories related to their presenting complaints, it does not follow that they can all be categorised in the same way. Elderly patients who have fallen are a good example of this. The next three cases show how the questioning of the patients is far more probing than in other trauma cases. Initially, the physician had to establish if there were any other factors responsible for the fall, such as; giddiness or the feeling of being unwell prior to falling; therefore the cause of the fall is the uncertain factor.

In Case 4, the patient was admitted to the ED with the trauma of a head injury causing a headache therefore it appeared that her presenting complaint was determined by her injury; however through the use of the medical diagnostic process the cause of her headache was found to be uncertain.
The narrative and subsequent medical case notes for the next four cases show the process that the physician undertook in his/her clinical reasoning.

Case 1: Presenting Complaint - fall

The physician introduced himself to the patient and then gained the patient's history:

Physician: *Can you tell me what happened?*

Patient: *I was going out to the outside dustbin and slipped on the ice.*

Physician: *Where are you hurt?*

Patient: *My shoulder and hip.*

Physician: *You slipped?*

Patient: *Oh yes.*

Physician: *You remember everything about it?*

Patient: *Yes.*

Physician: *And you just injured your hip and shoulder?*

Patient: *Yes – right side.*

Physician: *Did you bang your head?*

Patient: *No, thank goodness. I went against the drain pipe which saved me. I couldn't move. My neighbours came to my rescue.*

Physician: *How are you usually?*

Patient: *Pretty good, just arthritic.*

Physician: *Anything else I should know about you?*

Patient: *No. Just high blood pressure etc. On medication.*

Physician: *What are your home circumstances?*

Patient: *Live on my own, son lives near* [P.01/P.05].

Brief physical examination.

Physician: *You had x-rays taken in MIU I will just have look at them and see what is wha*

Documentary Evidence – Medical Notes	
Presenting complaint	Fall
History of Presenting Complaint	Slipped on ice. Fell hit hip and right arm on wall. Taken to MIU.
Past medical History	High B/P, arthritis.
On Examination:	appears well, alert, orientated, warm, well perfused. R arm tender proximal humerus. Elbow and wrist NAD. R hip, full movement. X – Ray from triage – no fractures.
Drug History	lots.
Social History	Lives alone, son lives nearby.
Impression/working diagnosis:	Bumps and Bruises.
Plan	Discharge.

In this case the physician asked questions to establish how the patient fell and what happened. Questions were also asked regarding the patient's usual state of health. X-rays showed no fractures, so the physician diagnosed bumps and bruises.

Case 2: Presenting complaint – fall

This patient presented to the ED complaining of having had a fall. The physician introduced himself to the patient and then gained the patient's history:

Physician: *Ok, what were you doing when you fell?*

Patient: *I was going out to the car. My daughter spoke to me and I turned around.*

Physician: *Toppled over, did you?*

Patient: *I didn't feel giddy or anything.*

Physician: *You didn't feel giddy, or faint or anything?*

Patient: *No.*

Physician: *You didn't knock your head as you went down?*

Patient: *No.*

Physician: *Any other problems?*

Patient: *Lots.*

Physician: *Got a list have you?*

Patient: *Diverticulitis, arthritis, osteoporosis etc.*

Physician: *What medication are you on?...list given.*

Do you walk with a stick? Are you normally independent?

Daughter to physician: *Mum lives on her own, just came down for Christmas.*

Physician examined patient. Feels down her spine.

Physician: *It is sore there?*

Patient: *Bit tender.*

Physician: *Can I just check your hips?* [P.03/P.26. F.82].

Physician: *We will x-ray your back, you may have an old fracture that you don't know about, but because you have osteoporosis we will check you out.*

Documentary Evidence – Medical Notes	
Presenting complaint	Back pain.
History of Presenting Complaint	Fell over am whilst getting into car. Turned to reply to daughter and loss balance and fell over, landed on back. No HI. No LOC. No Dizzyness. Remembers falling. Been able to mobilize since. No stroke, parathesis or weakness. Pt usually urinary incontinent.
Past medical History	Osteoarthritis. Osteoporosis. Trigeminal neuralgia.
On Examination:	well, walking but discomfort. No loss of sensation/power over limbs – central bony tenderness also paraspinal tenderness. Pelvis/hip ok.
Drug History	Adcal. Alerdonate.
Social History	Normally lives alone but with daughter for Christmas.
Impression/working diagnosis:	?lumbar fracture.
Plan	SR review – osteoporosis ? X-Ray owing to history of osteoporosis.

In this case, the physician asked questions related to the fall. The physician established that the patient was not giddy prior to the fall; therefore it was assumed that this was a mechanical fall. The patient's previous medical history informed the physician that the patient suffered from osteoporosis. Through the physician's biomedical knowledge that osteoporotic bones can fracture easily on falling and the fact that clinically on examination the patient complained of tenderness in her lower spine, the physician ordered an x-ray to prove or disprove his diagnosis of suspected fractured lumbar spine.

Case 3: Presenting Complaint – fall

The physician introduced himself to the patient and then gained the patient's history:

Physician: *Tell me what happened today.*

Patient: *Well, I was waiting for the nurse to come to dress my left leg, I have got an ulcer. Nurse visited and I ended up here. I had a fall two days ago.*

Physician: *Any pain anywhere? ... How did you fall?*

Patient: *I was just turning the telly off actually, I was just turning around and tripped over the biscuit box.*

Physician: *So you tripped over the biscuit box and where did you land?*

Patient : *On the floor.*

Physician: *Do you remember which part of your body to hit?*

Patient: *I managed to crawl and get up, and then I fell down again.*

Physician: *Any other injuries apart from the pain in your leg?*

Patient: *No* [P.04/P.17.M.84]. The physician then examined the patient.

Documentary Evidence – Medical Notes	
Presenting complaint	Fall.
History of Presenting Complaint	Sent in by district nurse today when she came to redress his leg ulcer. Difficulty mobilising since fall two days ago. Fall – trip over biscuit tin tried to get up and fell again No chest pain/SOB/dizziness/weakness/no post ictal symptoms. Injury to left hip/thigh – painful and weak. Difficulty on mobilising.
Past medical History	Ulcer (L)Leg since June 2010. DVT left leg. No DM/MI/Stroke.Fall ?when.
On Examination:	Left thigh bigger than right. Patient reports it has been like this for years. Bandage to left leg. Right leg skin dry and scaly. No bony tenderness (L) hip or femur. Patient able to lift left leg off bed but limited by pain.
Drug History	NKDA Aspirin 75mgs od.
Social History	lives alone.
Impression/working diagnosis:	?(L) fractured neck of femur. Not coping at home.
Plan	Left hip X-ray. Bloods FBC ?UandEs Rita referral. Discussed with senior.

In this case, the physician asked the patient questions related to the fall. The physician established that the patient was not giddy prior to the fall, therefore it was assumed that it was a mechanical fall. The patient's previous medical history informed the physician that the patient suffered from ulceration to his left leg and a previous DVT. On examination, the physician found that the patient's left leg was bigger than the right and its movement was limited. The physician was concerned by this and therefore requested an x-ray of the patient's left hip to prove or disprove his impression/working diagnosis of a fractured hip.

Case 4: Presenting complaint - head injury

Physician: *Can you tell me what has been happening?*

Patient: *I have had three bumps on my head in the last three days. One on a ramp. One on a shelf and one on a van door. The whole time my head has been sore, but the last one finished me off, my head is absolutely banging.*

Physician: *Not much luck... so three times in 3 days?...and the headaches started after the first time you bumped you head?*

Patient: *Kept going with work but going bed early and sleeping a lot. Feeling sick.*

Physician: *Have you been sick?*

Patient: *No, just feeling sick, all night, and I thought I was going to be sick this morning.*

Physician: *And where about is your headache?* (patient points to her forehead)

Patient: *It changes sometimes, it feels like someone is pressing down on my head.*

Physician: *Does anything make the pain easier?*

Patient: *Sometimes if I lie on my right side.*

Physician: *Is it worse in the morning?*

Patient: *Yes.*

Physician: *Does it hurt more when you forward?*

Patient: *No, but when I stand up.*

Physician: *How would you rate the pain, out of 10, 10 being the worse?.*

Patient: *8 or 9. I get migraines anyway.*

Physician: *Any changes in your vision at all?*

Patient: *My eyes are a bit sore but no blurred vision, not painful.*

Physician: *If I shined a light in your eyes would it be painful for you?*

Patient: *Light makes them hurt, on my way here, my son had to put the visor down in the car because of the light.*

Physician: *Does this feel like a migraine to you?*

Patient: *No, the pain is different, my normal migraine starts up here (patient points to side of head).*

Physician: *And how often do you get migraines?*

Patient: *It varies, sometimes I can go months.*

Physician: *Have you taken anything for the pain?*

Patient: *No, not this morning. I took codramol last night and the night before. Codramol knocks me out, which isn't a bad thing, it usually knocks me out all night but I was awake at 2am this morning.*

Physician: *And do you normally take anything when you have migraines?*

Patient: *I usually take codramol and go into a darkened room.*

Physician: *Alright, er, any funny noises in your ears?*

Patient: *I have got a funny ear anyway.*

Physician: *Any weakness in your legs or pins and needles?*

Patient: *I have just had an EMG for my legs before all this.*

Physician: *Oh alright, ok.*

Patient: *I have minor nerve damage. Usually, in bed at night my legs would be hot.*

Physician: *And you just get pins and needles in your legs at night?*

Patient: *Very rarely in the day. Just a wreck.*

Physician: *Any past history of anything else?*

Patient: *No, I am on a tablet for depression, I was about to come off that, but my dad died.*

Physician: *Do you take any other medications?*

Patient: *No*

Physician: *Allergic to any medications?*

Patient: *No.*

Physician: *Who do you live with?*

Patient: *My son.*

Physician: *Ok, do you want to hop up on the couch.*

Physician examines the patient (neurological senses, eyes following finger etc. reflexes etc. arms, legs mobility and strength).

Physician: *Ok, so all of the examinations are fine, difficult to say if it is just another migraine or something to do with the bumps to your head, but the good thing is that all your nerves are working well. Would you like some pain relief?*

Patient: *No thanks.*

Physician: *Ok, what I am going to do is to talk to one of my seniors about you. If you just take a seat back in the waiting room, I will work out your plan* [P.04/P14.F.47].

Documentary Evidence – Medical Notes	
Presenting complaint	Headaches x 3 bumps to head over 1 week.
History of Presenting Complaint	Headache started after 1st bump to head got progressively worse not relieved by analgesia. Worse am but not when leans forward. Describes photophobia. No neck stiffness, rash, visual disturbance, weakness, hearing loss, dizziness or fever.
Past medical History	migraine – this is different.
On Examination:	B/P114/74. Afebrile. Sats 99% on air. P 70. No neck stiffness.
Drug History	Antidepressant.
Social History	lives with son.
Impression/working diagnosis:	Head injury.
Plan	Cat scan requested, because of photophobia move to CDU.

In this case, the physician was presented with a strange history of a number of separate instances of head injuries over a period of one week. The physician established that the patient had a history of suffering from migraines. The physician emphasised in her medical notes that the patient had stated that this headache was different. The physician examined the patient and checked for signs of meningitis (neck stiffness, rash, and photophobia). The patient did not complain of any neck stiffness and clinically the physician found no evidence of a rash. However, the patient did complain of photophobia[40] which led the physician to request a cat scan to rule out any neurological problem.

[40] Photophobia - eyes sensitive to light

The narratives from the last four cases have shown how the physicians have used, in each case, a range of clinical reasoning approaches; pattern recognition, hypothetic-deductive reasoning, probabilistic, causal and deterministic reasoning and forward and backward reasoning(Chapter 2.4.1.5). This approach was very similar to their approach taken with the patients where the cause of their presenting complaint was uncertain.

5.3 How did the gathered information inform/influence the physicians clinical reasoning?

5.3.1 The use of the patient's history in clinical reasoning

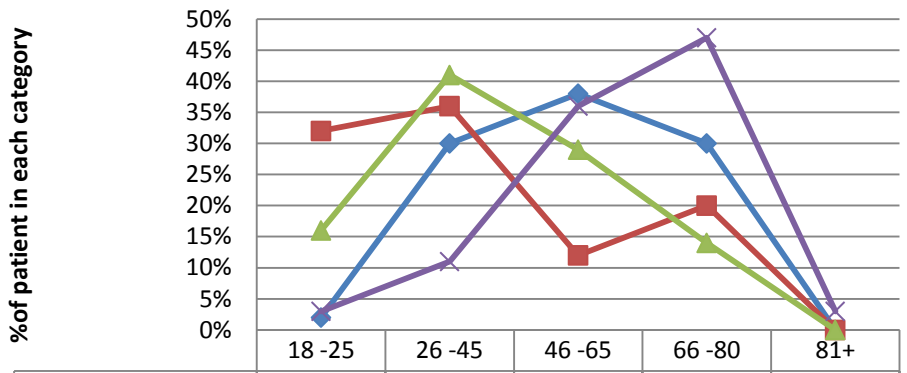
We have seen from the case studies shown previously in Section 2, that the patient's history was always important. The physicians spent time questioning the patient. My findings suggest that it was the history of the patients' signs and symptoms prior to their admission to the ED that informed the physicians' clinical reasoning. The amount of other historical information gathered and then recorded by the physicians in the medical notes did vary (Chapter 4.7.4). The use of the patient's narrative is discussed further in Chapter 6.

5.3.2 The use of the patient's sex in clinical reasoning

The sex of the patient did not appear to play a part in the physicians clinical reasoning except in the cases of female conditions, such as; a suspected miscarriage or gynaecological complaints.

5.3.3 The use of the patient's age in clinical reasoning

The four main categories of presenting complaints; chest pain, abdominal pain, collapse and trauma varied considerably in the age range of the patients. Personally, I could find negligible evidence that age played an important part in the physicians' clinical reasoning, but I think it is worth noting the differences between the groups.



	18 -25	26 -45	46 -65	66 -80	81+
Chest pain	2%	30%	38%	30%	0%
Abdominal pain	32%	36%	12%	20%	0%
Trauma	16%	41%	29%	14%	0%
Collapse	3%	11%	36%	47%	3%

Chart 5.1- Age range in presenting complaints groups

Although age did not seem to play a part in the physicians' clinical reasoning. I initially thought that age may have played a part in the management of the patients, for example, whether to admit the patient or discharge them. My assumption was that the admission rate for patients in the elderly age range of 66-80years old, would have been much higher than it was. Please see Chart 1

for detail.

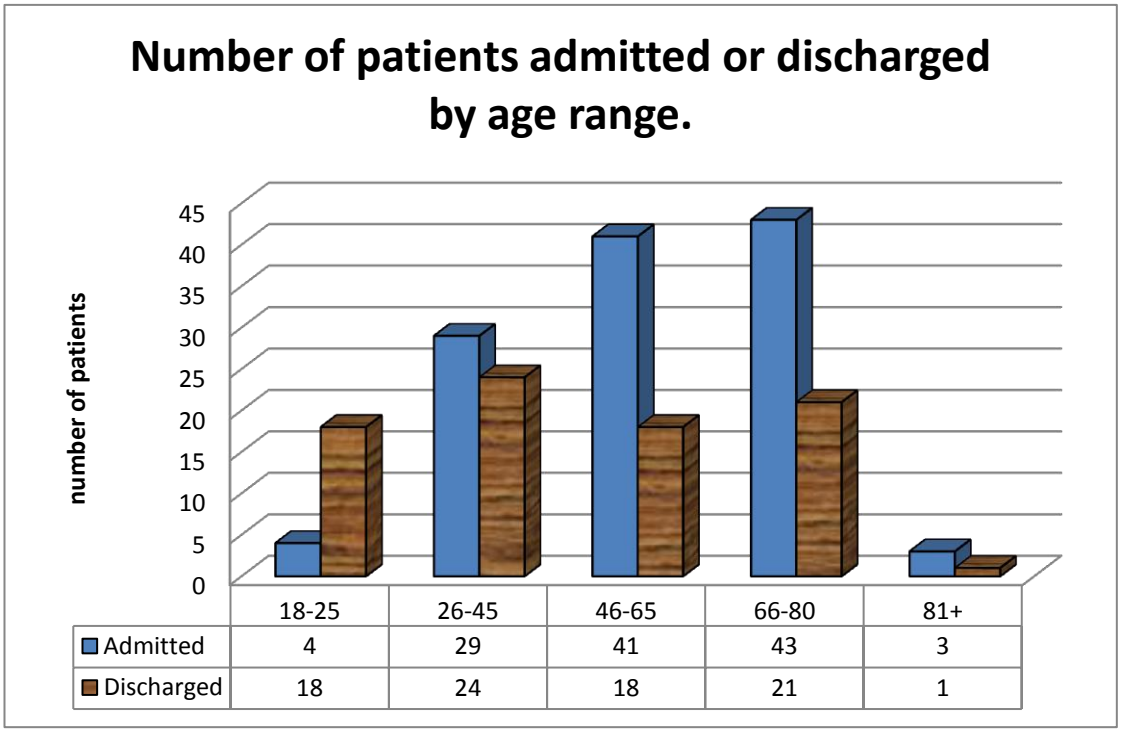


Chart 5.2 – Number of patients admitted or discharged by age range.

Interestingly, this was not the case. The admission of the patients in all age groups varied depending of their diagnosis. Although, the management of the patient, following a diagnosis being formed was not part of my remit, I decided to explore this further. I felt that I could not talk about the probability of a diagnosis being made without highlighting that a large number of patients were admitted to another ward in the hospital. These patient were either awaiting blood results; in the case of the patients with a diagnosis of cardiac chest pain their Troponin levels or having further tests, investigations or treatment carried out. Chart 2 shows the admission rate by age range in some of the main categories of impression/working diagnoses made.

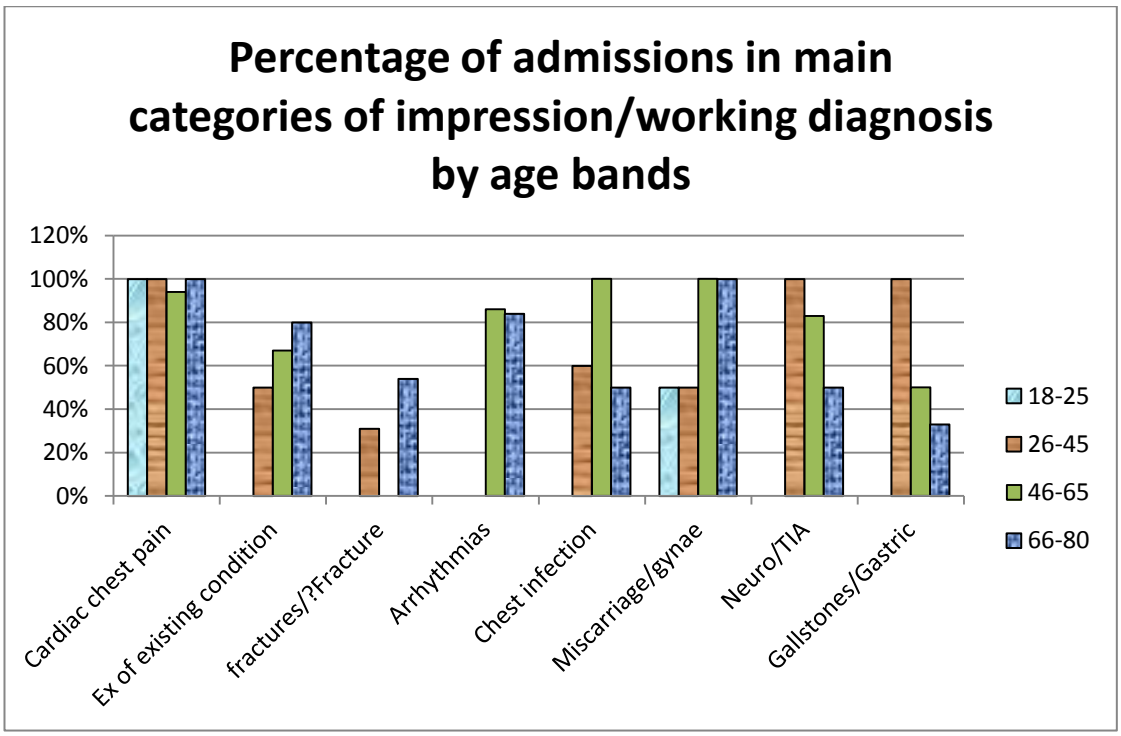


Chart 5.3 - % of admissions in main categories regarding admission or discharge.

Other categories not shown showed a similar distribution within age bands. The four patients who were in the 81+years old age range, were not included in the chart. Three of these patient were admitted with fractures.

5.3.4 The use of observations/examinations/investigations in clinical reasoning

As shown in Chapter 4. Section 4, physicians felt that observations were a key element of the medical diagnostic process. When examining and exploring my data, I found that only a small number of patients in each group had observations that were abnormal recorded in their medical notes. The majority of patients either had normal observations or no observations recorded in their medical notes.

In Group 1(n.117) there was a higher incidence of abnormal observations recorded in the patient's medical notes following the physicians clinical assessment leading to his/her formation of a medical diagnosis. In Group 2 (n.85) the recorded abnormal observations were markedly lower. Chart 3 shows a comparison between Group 1 and Group 2:

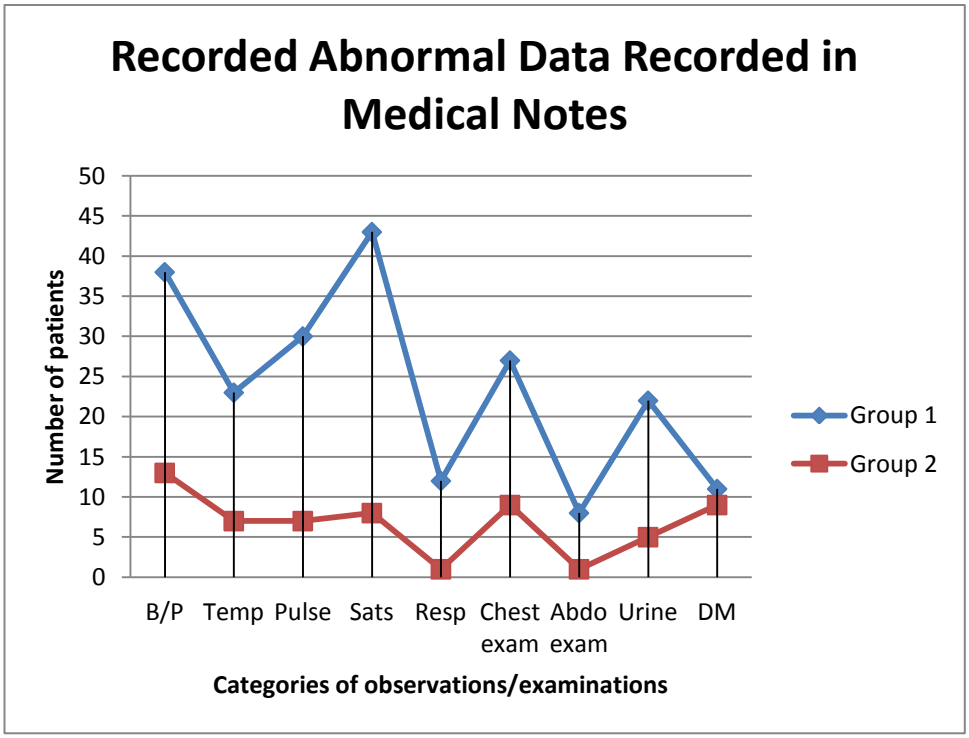


Chart 5.4 - Distribution of abnormal observations recorded in medical notes between two groups; Group 1 and Group 2

Chart 3 shows the distribution of abnormal observations recorded between the two groups; Group 1 and Group 2. This supports the theory that the patients in Group 1 have more data recorded in their medical notes than the patients in Group 2. It also shows that the data recorded is shows a difference in the number of patients with recorded abnormal observations between the two groups.

However, this finding on its own did not shed any light on how/if these abnormal observations informed/influenced the physicians clinical reasoning. I found that patients in the trauma group, had abnormal observations recorded in their medical notes which did not appear to influence the physicians' impression/working diagnosis.

I decided that the only way to understand if abnormal observations informed/influenced the physician's clinical reasoning was to breakdown the Groups; Group 1 and Group 2 into their original presenting complaints categories. This enabled me to link the clinical data to the clinical presenting complaint (Chapter 3.8.4).

Chart 4 shows the percentage of patients in each presenting complaint category that had abnormal observations/examinations recorded in their medical notes.

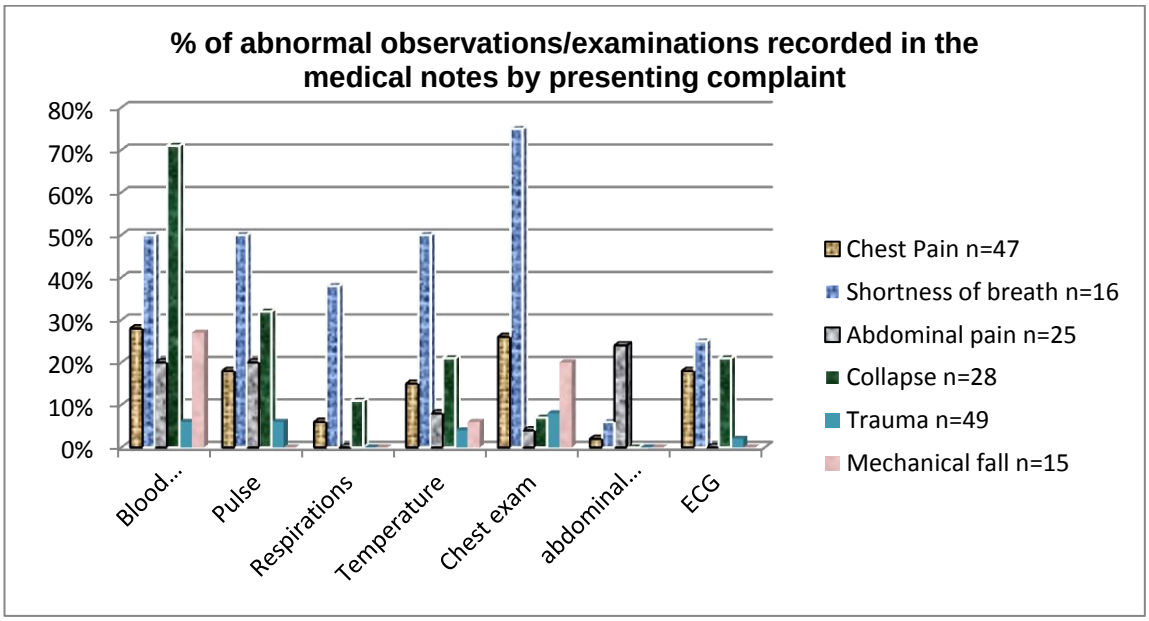


Chart 5.5 – Percentage of abnormal observations/examination recorded in the medical notes by presenting complaint categories.

On further exploration of these findings, some of the abnormal observations did concur with the patients presenting complaint and the physicians' impression/working diagnosis.

5.3.5 The influence the presenting complaint, abnormal observations and abnormal physical examination may have had on the physician's clinical reasoning leading to his/her formation of an impression/working diagnosis.

5.3.5.1 Presenting complaint – shortness of breath

In this category, 72% of the patients who presented with shortness of breath, had an abnormal chest examination recorded in their medical notes; indicating that when the physician examined the patient's lungs (using a stethoscope) their lungs were not found to be clear as the physician heard crepitations/ crackles when the patient inhaled and exhaled. Out of these patients 50% also had a high temperature and a rapid pulse recorded in their medical note which commonly indicates an infection.

The relevance of these abnormal observations and how they probably played a part in the clinical reasoning used by the physicians is shown in Chart 5, which shows the impression/working diagnosis that the physician made following his/her assessment of the patient.

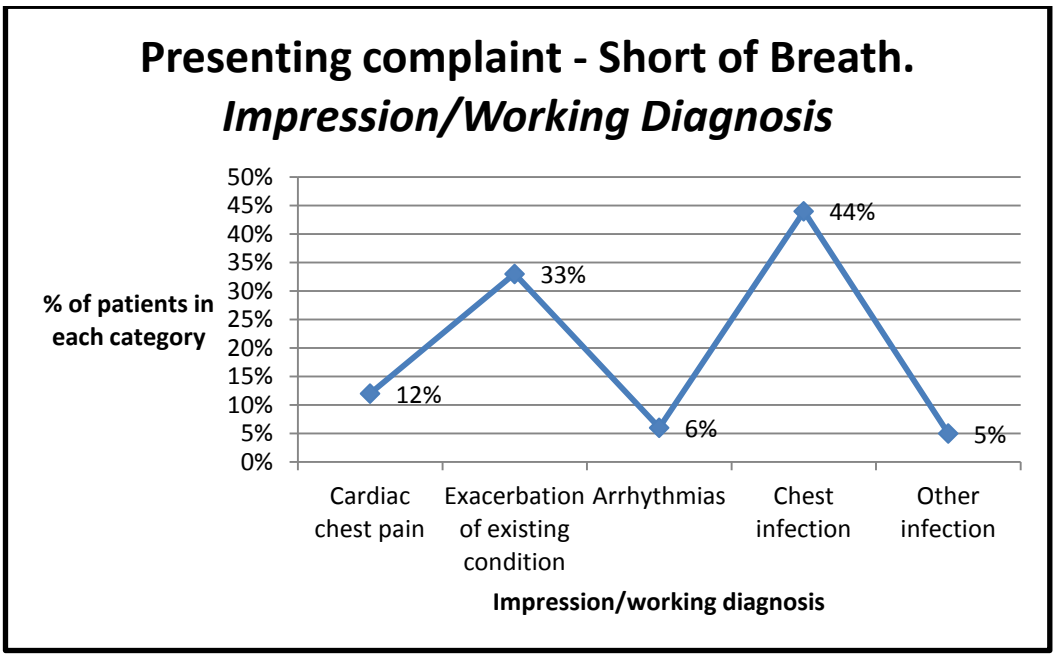


Chart 5.6 – Presenting complaint – short of breath. Impression/working diagnosis

The impression/working diagnosis of a chest infection accounted for 44% of the patients who were admitted with the presenting complaint, shortness of breath. Another 5% of the patients had an infection elsewhere, this seemed to correspond with incidence of high temperature recorded in the medical notes of 50% of the patients in this category. 33% of the patients had an exacerbation of an existing condition; in these cases the patient usually had a history of chronic lung problems/disease.

Abnormal ECGs were recorded in 24% of the patients' medical records, this probably accounted for the impression/working diagnosis of arrhythmias[41] as the physician would have been able to recognise this abnormality on the ECG. The diagnosis of cardiac pain which accounted for 12% of the patients in this category was likely to have been based on both the patients' history regarding the type of pain/ duration of pain etc and may have been related to an abnormal blood pressure, pulse or ECG.(as discussed in 2.1above).

[41] Arrhythmias - irregular heart beat

5.3.5.2 Presenting complaint – Collapse

The causes of collapse can be diverse. In this category, 70% of the patients who presented having collapsed had an abnormal blood pressure reading recorded in their medical notes, 20% also had an abnormal ECG. Looking at the impression/working diagnosis made by the physician for patients who presented having had a collapse, we can see that these abnormal observations appeared to have played a part in their clinical reasoning. 39% of the patients were diagnosed as having arrhythmias this is a common probable reason for collapse, hence the high level of ECGs recorded in the medical notes. Another impression/working diagnosis given by the physician for 32% of the patients, was a neurological cause such as a stroke/TIA[42] these conditions are commonly associated with high blood pressure.

An abnormal temperature was recorded in 20% of the patients' medical notes and Chart 6 below shows that 10% of the patients were diagnosed as having an infection. Poor diabetic control accounted for the diagnosis for 3% of the patients.

Interestingly, although an impression/working diagnosis of gallstones/gastric was given for 4% of the patients presenting having had a collapse, none of them had an abnormal abdominal examination recorded in their medical notes.

[42] T.I.A. - transcient ischemic attack – where there is a temporary problem with the supply of blood to the brain)

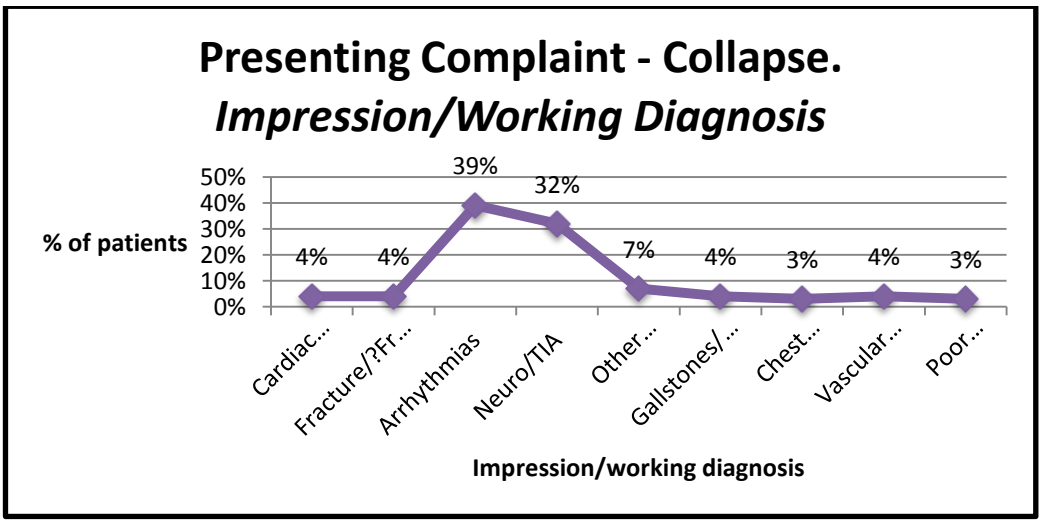


Chart 5.7 – Presenting complaint – Collapse. Impression /working diagnosis.

5.3.5.3 Presenting complaint – chest pain

In this category, although there were abnormal observations shown in the medical notes, none of them were outstanding (Chart 7). Only 28% of the patients presenting with chest pain had an abnormal blood pressure; 16% abnormal pulse; 15% abnormal temperature, 16% abnormal ECG and 22% abnormal chest examination recorded in their medical notes. However, the impression/working diagnosis formed by the physician and written in the patients medical notes showed that 75% of the patients who presented with chest pain were thought to have cardiac chest pain. In this category it appears that the impression/working diagnosis was based on the patients' history and presenting signs and symptoms (as shown in 2.1) rather than observations and examinations. When the patient had experienced their chest pain >6 hours before their admission to the ED, the physician was able to confirm his/her diagnosis by a conclusive blood test (troponin) which ruled in or out a heart attack. If the patient's pain was < 6 hours before their admission to the ED they were admitted to a ward to wait to have the blood test taken.

The impression/working diagnosis of chest infection/pleuritc pain accounted for 15% of the patients; this corresponded with the abnormal temperatures recorded in the medical notes. However although only 2% of the patients were diagnosed as having arrhythmias, 16% were recorded as having an abnormal ECG. A further 12% of the patients had a request for an ECG to be carried out once they were admitted to a ward recorded in their medical notes.

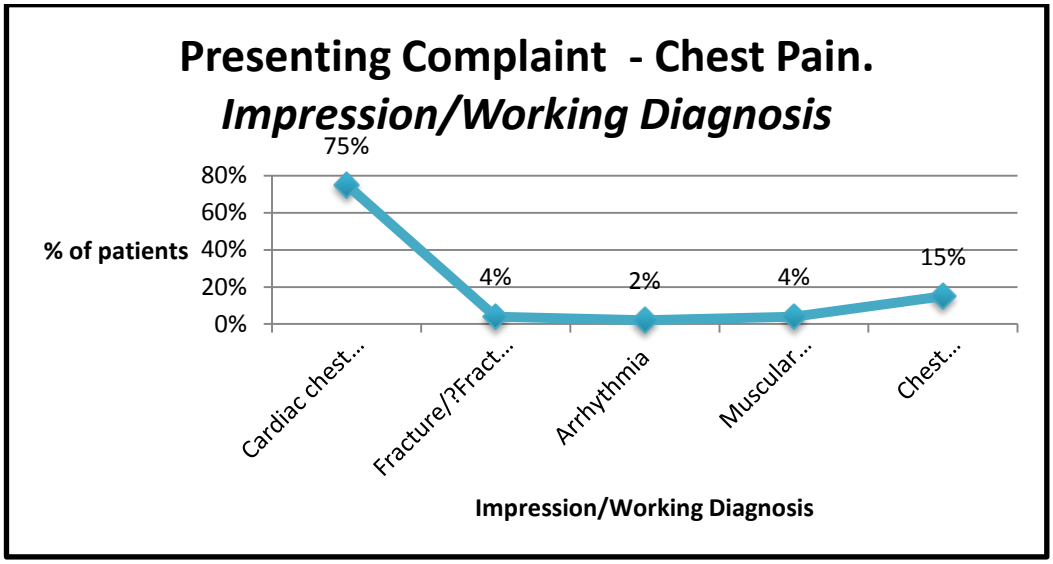


Chart 5.8 – Presenting complaint – Chest Pain. Impression/working diagnosis

5.3.5.4 Presenting complaint – abdominal pain

In this category, although the patients were admitted with abdominal pain, the impression/working diagnosis recorded in the medical notes by the physicians, following their clinical assessment of the patients, shows a variety of causes for their presenting complaint. The physicians' clinical reasoning led them to deciding that 36% of the patients had a probable diagnosis of gallstones of gastric problems;16 % of the patients were found to have a miscarriage or gynaecological problems. Interestingly, only 22% of the patients had a abnormal abdominal examination recorded in their medical notes. Once again this shows

that the patients' history played an important part in the physicians reasoning, as did the age and sex of the patient in some cases. An example of this is shown in Case 5.

In this category 4% of the patients had an abnormal chest examination recorded in their medical notes, corresponding with the impression/working diagnosis of 4% of the patients having a chest infection. A further 28% of the patients had a recorded impression/working diagnosis of an infection; but only 8% had a high temperature recorded in their medical notes, however further exploration of my data found that 44% of the patient had an abnormal urinalysis test recorded in their medical notes, which could account for the impression/working diagnosis of a probable urine infection.

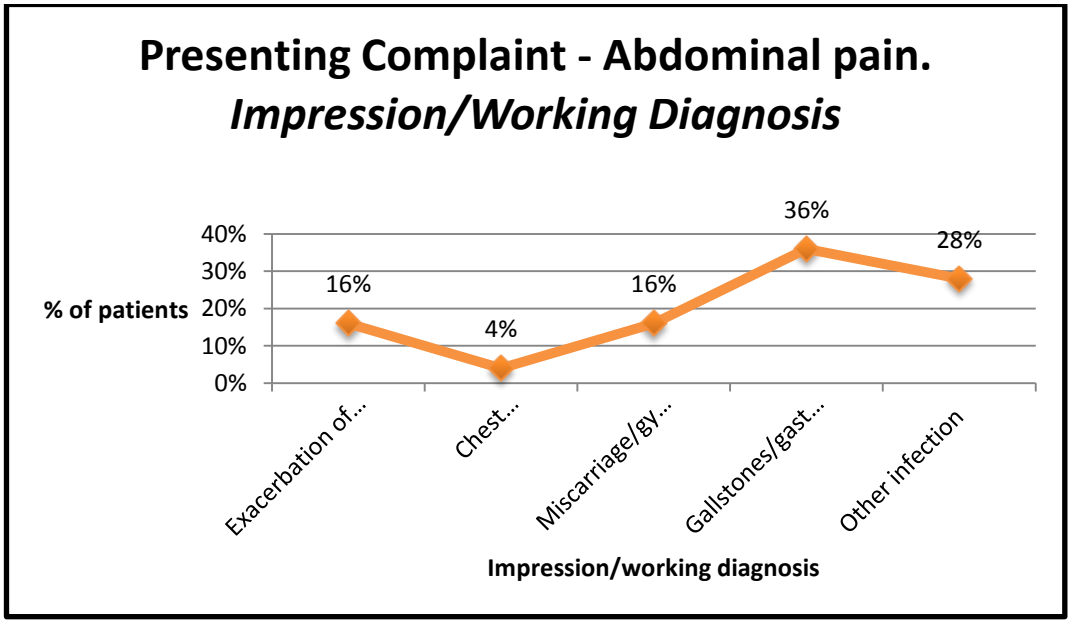


Chart 5.9 – Presenting complain – Abdominal pain. Impression/working diagnosis

5.3.5.5 Presenting complaint – Trauma

In this category, observations appeared to be less important in the diagnosis of the cause of the presenting complaint. This is evident from the lack of recorded data in the patients' medical notes concerning any observations recorded. Other than 4% of the patients having a high temperature recorded and 8% of the patients having an abnormal chest examination recorded, there is very little else. The incidence of high temperature and abnormal chest examination corresponds to the impression/working diagnosis of other infection recorded in the medical notes for 8% of the patients in this category.

The majority of patients are recorded has having a fracture /?(queried) fracture (45%) or muscular pain or soft tissue damage (33%).

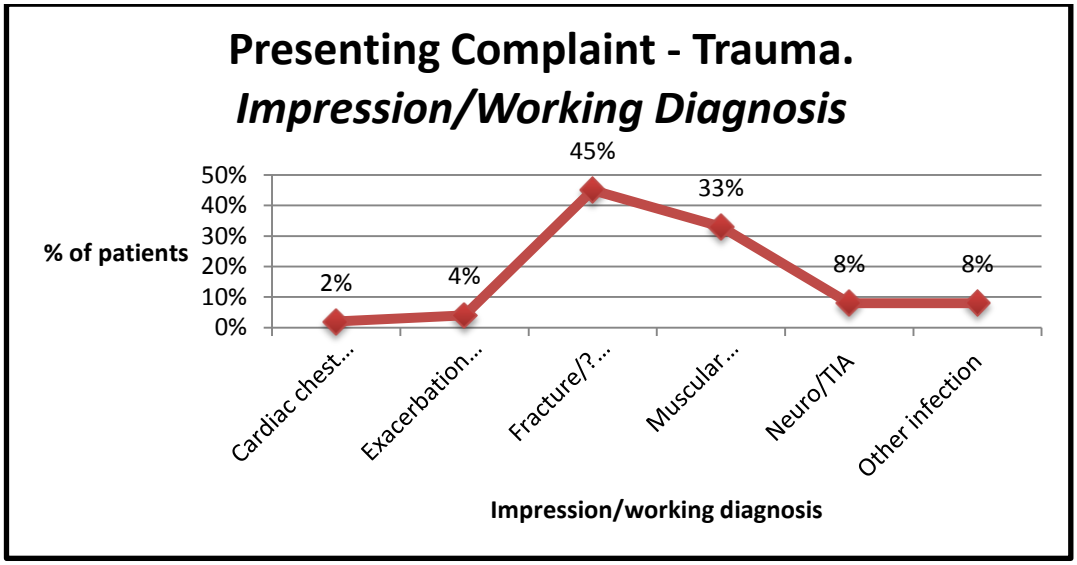


Chart 5.10 – Presenting complaint – Trauma. Impression/working diagnosis

5.3.5.6 Presenting complaint – Mechanical Fall

The impression working diagnosis recorded in the medical notes for patients in this category was either fracture/? Fracture (81%) or muscular pain/soft tissue

damage (19%). Nonetheless an interesting finding was that 20% of the patients were recorded as having an abnormal chest examination and 4% a high temperature and yet no one was given an impression/working diagnosis of an infection, as we have seen happening in other groups.

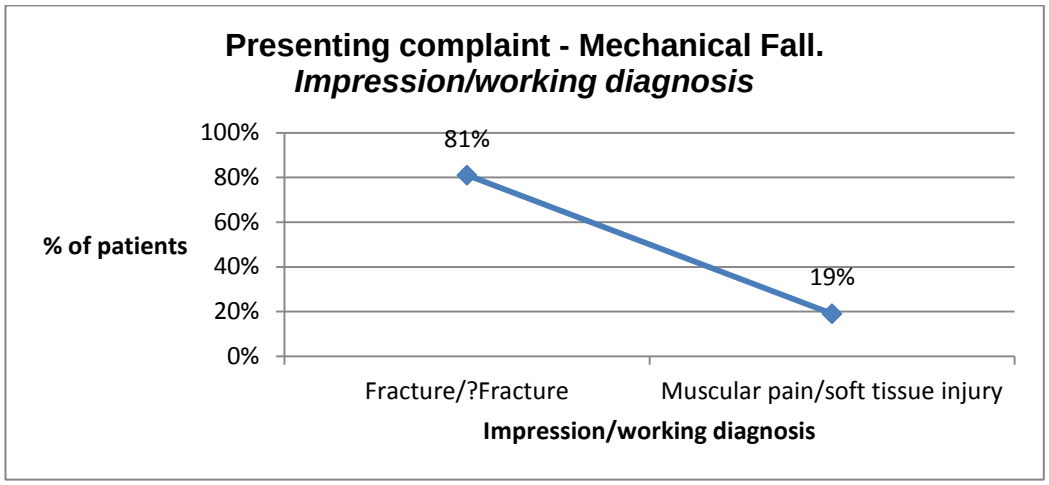


Chart 5.11 - Presenting complaint – Mechanical Fall. Impression/working diagnosis

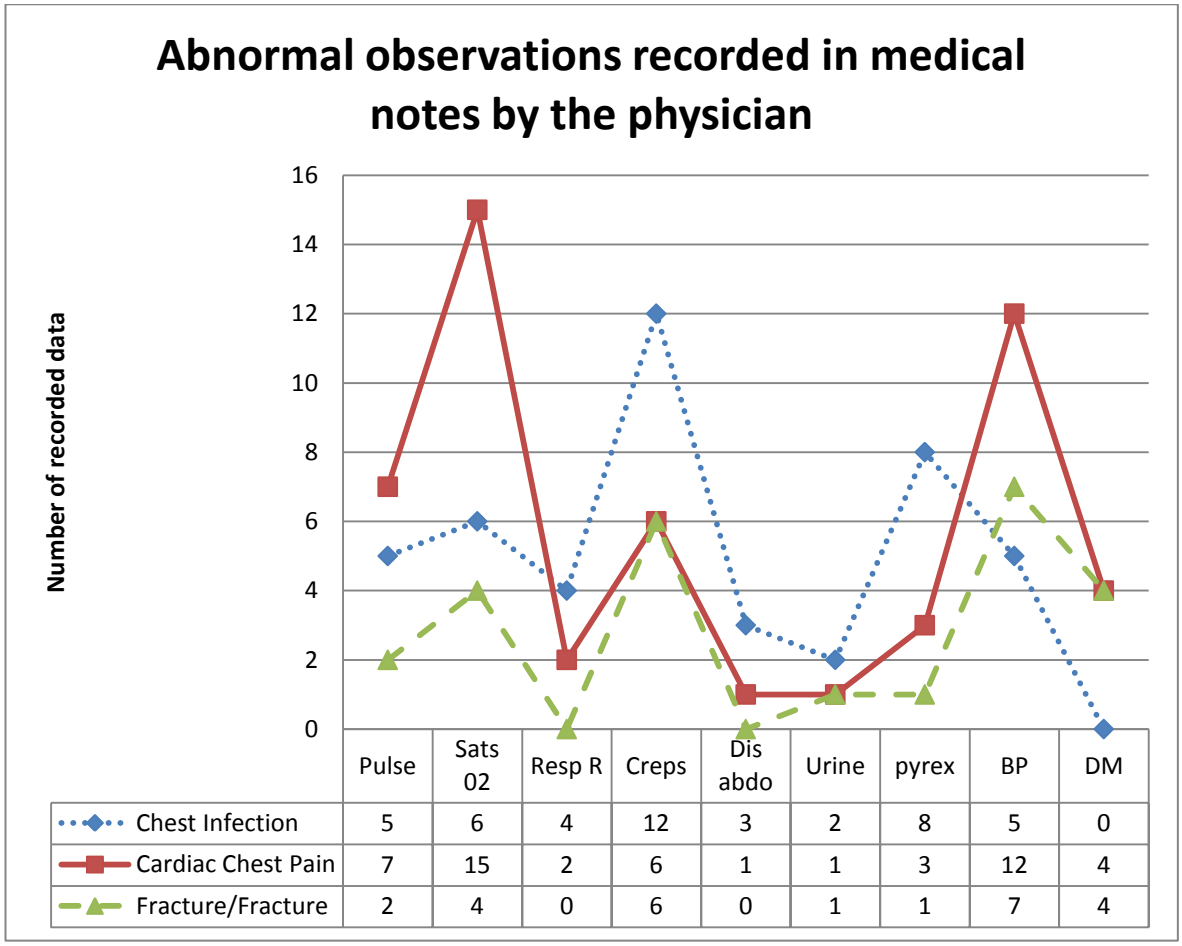
5.4 Comparative information – Causal attribution?

Previously in Section 3, I have discussed some of the findings regarding abnormal observation/examination and investigations recorded in the patients' medical notes. This was related to presenting complaints; chest pain, collapse, shortness of breath, trauma, abdominal pain and mechanical fall.

In this section, I focus on three groups of patients where the physician had decided that the impression/working diagnosis of the cause of the patient's presenting complaint was; cardiac chest pain, chest infection or a fracture/?fracture.

The following two charts illustrate the difficulty in causal attribution facing the physicians when making their diagnosis. Chart 11 shows the presenting

complaint compared to the impression/working diagnosis made. The patients who had the impression/working diagnosis of a chest infection or cardiac chest pain had presented with a variety of presenting complaints. The patients who had the impression/working diagnosis of fracture or suspected fracture had presented with trauma (the two complaints of chest pain were also related to trauma). This comparison shows how the way in which the patient presents his/her signs and symptoms could mislead the physician's clinical reasoning.



	Pulse	Sats 02	Resp R	Creps	Dis abdo	Urine	pyrex	BP	DM
Chest Infection	5	6	4	12	3	2	8	5	0
Cardiac Chest Pain	7	15	2	6	1	1	3	12	4
Fracture/Fracture	2	4	0	6	0	1	1	7	4

Chart 5.12 - Abnormal data recorded in medical notes

Although these findings were interesting, they did not provide me with any case based findings, such as; the combination of abnormal observations for each patient. I decided to undertake further analysis using QCA, using the data from

the same three groups. Unfortunately, the results were poor and inconclusive (Chapter 3) , however, I still felt that my case-based data could provide a probable causal explanation for how the physicians in my study formed an impression/working diagnosis of what they thought was the probable cause of a patient's presenting complaint.

I decided to explore individual cases in these three groups; cardiac chest pain, chest infection and fracture/suspected fracture. I compared the individual cases in each group to compare them with other cases within the same group. Using this case-based probability, I examined the evidence of what may have caused the physicians to form their impressions/working diagnoses in each case. The reason for using case-based probability is that it is 'ontological in character as it refers to real cases, with each case having its own probability of a given causal outcome. The probability refers to the actual character of the social world which itself is contingent' (Williams, 2009:7).

My aim was to see if the recorded abnormal observations or other information gathered provided a causal condition which influenced the physician's clinical reasoning leading to him/her forming their impression /working diagnosis as to the cause of the patient's presenting complaint. My findings are shown in Tables 1, 2 and 3. The columns of each table are represented by abbreviated titles. These are:

ID – the patient's identification number

Sex – M=male. F=female

B/P – Blood pressure volume recorded in medical notes

Temp – Body temperature recorded in medical notes

Pulse – Pulse rate recorded in the medical notes

Sat O2 – Oxygen level recorded in the medical notes

Resp – Rate of respiration recorded in medical notes

Chest – Chest examination recorded in medical notes

Abdo – Abdominal examination recorded in the medical notes

Urine – Urine dip requested /urinalysis recorded in the medical notes

DM – Diabetes Mellitus recorded in the medical notes

Chest x-ray – Chest x-ray recorded or requested in the medical notes

Other x-ray – Other x-rays recorded or requested in the medical notes

PRH – Previous relevant history recorded in the medical notes

ECG – Abnormal electrocardiogram recorded or requested in the medical notes.

Please note : In Table 5.1, 5.2, and 5.3, the shaded red squares represent abnormal observations and physical examination recorded in the medical notes. The shaded green squares show that the patient had normal observations and examinations recorded in the medical notes. The marked x in each box represents that the information was not recorded in the medical notes. The shaded pink area on the chart denotes if the patient had a x-ray recorded/requested in their medical notes; previous cardiac/significant family history recorded and an ECG recorded or requested in the medical notes.

Impression/working diagnosis – cardiac chest pain – n.38

Case ID	Sex	Age	B/P	Temp	Pulse	Sat O2	Resp	Chest exam	Abdo exam	Urine	DM	Chest x-ray	other x-ray	PCH/ FH	ECG
9	M	79		x		x				x	x	x	x	x	x
11	M	56		x		x		x				x	x	No	
18	F	46								x	x	Yes	x	Yes	
22	M	55								x	x	Yes	x	No	
30	F	56		x		x				x	No	Yes	x	Yes	
100	M	79		x		x	x			x	No	x	x	Yes	x
102	F	85								x	No	x	x	No	
41	F	68								x	No	x	x	Yes	x
84	F	59							x	x	No	x	x	Yes	
90	M	58				x				x	No	Yes	x	No	
112	M	53								x	Yes	Yes	x	x	R
114	M	52		x						x	No	Yes	x	Yes	
122	M	85				x		x	x	x	Yes	Yes	x	Yes	
202	M	65								x	No	Yes	x	Yes	
193	M	52				x				x	No	x	x	Yes	
195	M	24		x						x	No	x	x	x	
73	M	66		x						x	No	Yes	x	Yes	R
200	M	49								x	No	x	x	x	R
153	M	63		x					x	x	No	Yes	x	Yes	
163	F	64								x	No	Yes	x	Yes	x
165	M	68	x	x	x	x	x			x	No	Yes	x	Yes	x
171	M	70						x	x	x	No	x	x	Yes	R
174	M	43								x	No	Yes	x	x	
175	M	53	x	x	x	x	x		x	x	No	x	x	Yes	
181	F	81								x	No	Yes	x	Yes	x
184	M	30		x				x	x	x	No	Yes	x	Yes	
128	M	50						x		x	No		x	Yes	R
129	F	85								x	No	Yes	x	Yes	
146	M	77		x						x	No	Yes	x	Yes	x
149	F	62				x				x	No	x	x	Yes	R
70	M	50		x						x	No	Yes	x	Yes	
79	F	73		x					x	x	No	Yes	x	Yes	R
64	F	46								x	No	Yes	x	Yes	x
51	M	87								x	No	x	x	Yes	x
75	F	77		x					x	x	No	x	x	Yes	x
71	F	83	x	x	x	x	x			x	No	x	x	x	

Case ID	Sex	Age	B/P	Temp	Pulse	Sat O2	Resp	Chest exam	Abdo exam	Urine	DM	Chest x-ray	other x-ray	PCH/ FH	ECG
73	M	66		x						x	No	Yes	x	Yes	R
42	F	77			x	x	x			x	No	Yes	x	Yes	R

Table 5.1 – Impression/working diagnosis cardiac chest pain .

Abnormal observations recorded in the medical notes.
Normal observations recorded in the medical notes.
X - Not recorded in medical notes.
R - Requested

Table 5.1 shows causal conditions which may have influenced the physicians clinical reasoning. The pattern of recorded abnormal observations is random and does not provide a clear indication of which causal conditions influenced the physicians clinical reasoning. In cases of the patients with the ID 9 and 195, no abnormal observations were recorded, however on exploring these cases further, I found that the physician had recorded in the medical notes that the patients were complaining of chest pain; rated by the patients as 7-10 (10 representing the highest on the pain scale).Therefore, this may have influenced their clinical reasoning.

Impression/working diagnosis - Chest infection-n.17:

Case ID	Sex	Age	B/P	Temp	Pulse	Sat O2	Resp	Chest exam	Abdo exam	Urine	DM	Chest x-ray	other x-ray	PRH	ECG
10	M	65				x					No	Yes	x	Yes	
20	M	54								x	x	Yes	x	Yes	
40	F	21								R	No	x	x	Yes	x
32	M	67								R	No	Yes	x	Yes	
82	M	59				x				x	No	Yes	x	x	
92	F	73							x	x	No	Yes	x	Yes	
110	M	26								x	No	Yes	x	x	R
115	M	71									No	x	x	Yes	x
191	M	39	x	x	x				x	x	No	Yes	x	Yes	x
154	F	30	x						x		No	Yes	x	Yes	x
162	M	69			x	x	x		x	x	No	Yes	x	Yes	x
172	M	59								x	No	Yes	x	Yes	x
130	F	62								x	No	Yes	x	Yes	R
136	F	52								x	No	Yes	x	Yes	R
138	M	70		x							x	Yes	x	Yes	
78	M	41								x	No	Yes	x	x	
59	M	31									No	Yes	x	x	

Table 5.2 – Impression/working diagnosis – chest infection.

abnormal observations and other information recorded in the medical notes.

Normal observations recorded in the medical notes.
X - Not recorded in medical notes.
R - Requested

Table 5.2 shows a very different picture to Table 5.1. In Table 5.2 there is more clinical evidence/causal conditions shown in the majority of cases. This implies that this information influenced the physicians' clinical reasoning.

Impression/working diagnosis – Fracture/ Suspected fracture-n=38

Case ID	Sex	Age	B/P	Temp	Pulse	Sat O2	Resp	Chest exam	Abdo exam	Urine	DM	Chest x-ray	other x-ray	PRH	ECG
2	M	70				x	x	x	x	x	x	Yes	Yes	Yes	x
26	F	82	x	x	x	x	x	x	x	x	x	x	x	x	x
17	M	84	x	x	x	x	x	x	x	x	x	x	x	x	x
45	M	45								R	No	Yes	Yes	x	x
46	F	96								x	No	Yes	Yes	Yes	x
25	F	80		x	x	x	x		x	x	No	Yes	Yes	x	x
47	F	79	x	x	x	x	x		x	x	x	x	Yes	x	x
48	F	64	x	x	x	x	x		x	x	x	x	Yes	x	x
104	M	75	x	x	x	x	x		x	x	x	x	Yes	x	x
106	M	32	x	x	x	x	x		x	x	x	x	Yes	x	x
38	F	80	x	x	x	x	x		x	x	x	x	Yes	x	x
85	F	22	x	x	x	x	x	x	x	x	x	x	Yes	x	x
86	F	52	x	x	x	x	x	x	x	x	x	x	Yes	x	x
87	F	45		x							No	x	Yes	x	x
88	F	18		x					x	x	x	x	Yes	x	x
89	M	43		x		x		x	x	x	x	x	Yes	x	x
96	M	72							x	x	x	x	Yes	Yes	x
108	M	63	x	x	x	x	x	x	x	x	x	x	Yes	x	x
109	M	25	x	x	x	x	x	x	x	x	x	x	Yes	Yes	Yes
119	M	60	x	x	x	x	x	x	x	x	x	x	Yes	Yes	Yes
120	M	42	x	x	x	x	x	x	x	x	x	x	x	Yes	x
166	F	80		x				x		x	x	Yes	Yes	Yes	x
169	M	41	x	x	x	x	x	x	x	x	x	x	Yes	x	x
176	M	26		x					x	x	x	x	Yes	x	x
177	M	49	x	x	x	x	x	x	x	x	x	x	x	Yes	x
180	F	86		x	x	x	x	x	x	x	x	x	x	Yes	x
182	F	75	x	x	x	x	x	x	x	x	x	Yes	Yes	Yes	x
183	F	30						x	x	x	x	x	Yes	x	x

Case ID	Sex	Age	B/P	Temp	Pulse	Sat O2	Resp	Chest exam	Abdo exam	Urine	DM	Chest x-ray	other x-ray	PRH	ECG
185	F	73	x	x	x	x	x	x	x	x	x	x	Yes	x	x
127	M	30		x						x	x	Yes	Yes	x	x
135	F	96		x						x	x	x	Yes	Yes	x
132	M	46										Yes	Yes	x	x
133	M	56					x				x	Yes	Yes	x	x
145	M	28	x	x	x	x	x	x	x	x	x	x	Yes	x	x
148	F	93	x	x	x	x	x		x		x	x	Yes	x	x
150	M	44	x	x	x	x	x		x	x	x	x	Yes	x	x
69	F	79	x	x	x	x	x		x	x	x	x	Yes	x	x
60	M	90										x	x	x	x

Table 5. 3- Impression/working diagnosis – fracture/?fracture.

abnormal observations and other information recorded in the medical notes.
Normal observations recorded in the medical notes.
X - Not recorded in medical notes.
R - Requested

Table 5.3 shows that there was scant information/causal conditions recorded in the patient's medical notes on which the physicians based their clinical reasoning. This table supports the previous findings which showed that the impression/working diagnosis was determined by the injury. The table also shows that the majority of the cases had an x-ray taken or requested to rule in or rule out the diagnosis made.

Impression/working diagnosis – gallstones/gastric problem, n = 11:

Case ID	Sex	Age	B/P	Temp	Pulse	Sat O2	Resp	Chest exam	Abdo exam	Urine	DM	Chest x-ray	other x-ray	PRH	ECG
21	M	61								x	No	Yes	x	x	x
35	M	73								R	No	x	x	Yes	x
94	M	69							x	x	No	x	x	Yes	x
99	M	78	x	x	x	x	x				No	x	Yes	Yes	x
125	F	21									No	Yes	x	x	x
188	F	93									No	Yes	x	Yes	x
167	M	28								R	No	x	x	x	x
168	M	23									No	x	x	x	x
43	F	89								x	No	x	x	x	x
76	M	39					x	x	x		No	x	x	x	x
61	M	26	x	x	x	x	x	x		x	No	x	x	Yes	x

Table 5. 4 – Impression/working diagnosis –gallstones/gastric problems

abnormal observations and other information recorded in the medical notes.
Normal observations recorded in the medical notes.
X - Not recorded in medical notes.
R - Requested

Table 5.4 shows that there was scant information/causal conditions recorded in the patient's medical notes on which the physicians based their clinical reasoning. It is difficult to see which causal conditions supported the diagnosis of gallstones/gastric problem. The abdominal examination was either not recorded or recorded as normal in 82% (9/11) of the patients. The most common causal condition shown was urinalysis dip requested or abnormal. These tables are discussed further in Chapter 6.

5.5 Blending clinical reasoning and evidence-based medicine in clinical practice

As previously mentioned in Section 2, the clinical reasoning used by the physicians was a combination of various clinical reasoning approaches depending on the uncertainty as to the cause of the patient's presenting complaint.

During the interview process with the physicians, I asked them how they blend their clinical reasoning skills with evidenced –based medicine in the clinical setting. Evidenced based medicine appeared to be valued by the physicians who took part in my research study. The views they expressed at their interviews are shown in Chart 5.13.

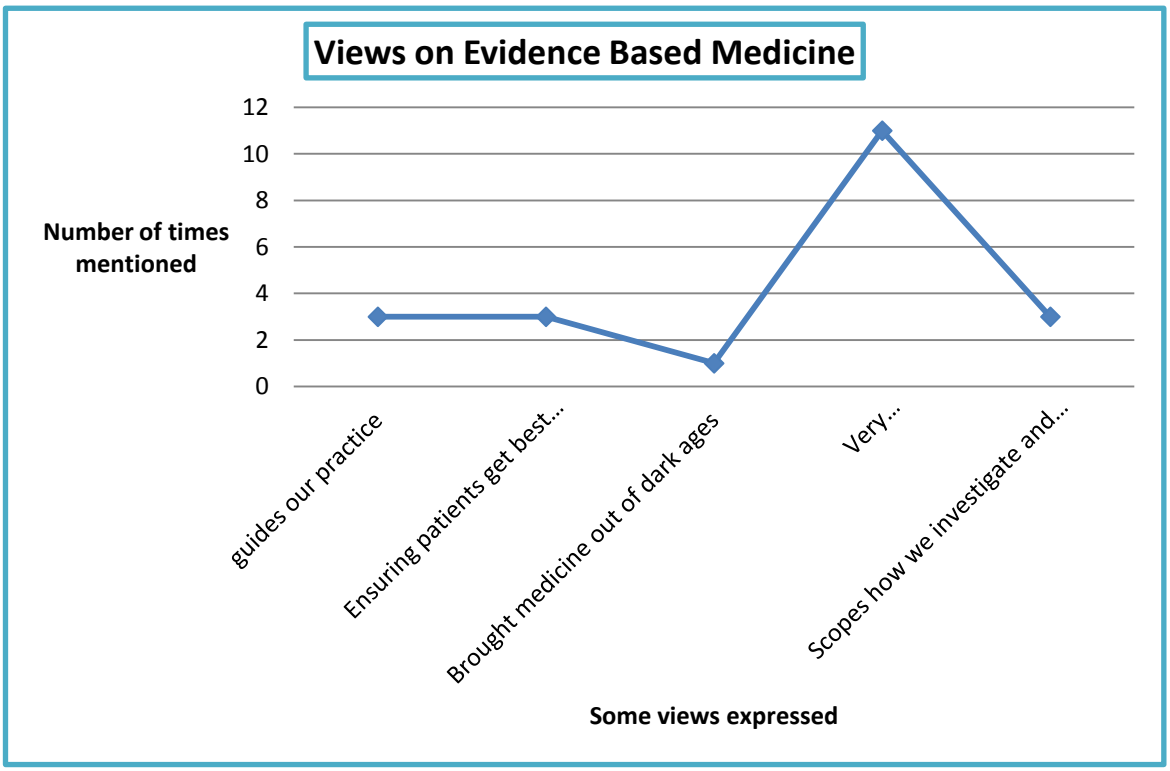


Chart 5.13 – Physicians' views on evidenced-based medicine

Within the ED, there was a wealth of guidelines and protocols accessible on line for the physicians to use. These protocols were based on evidence based medicine and provided information regarding the management of patients.

The availability of these guidelines and protocols was particularly appreciated by the junior physicians. When asked how they blend their clinical reasoning with evidenced based medicine, it was these guidelines and protocols that were mentioned by the physicians.

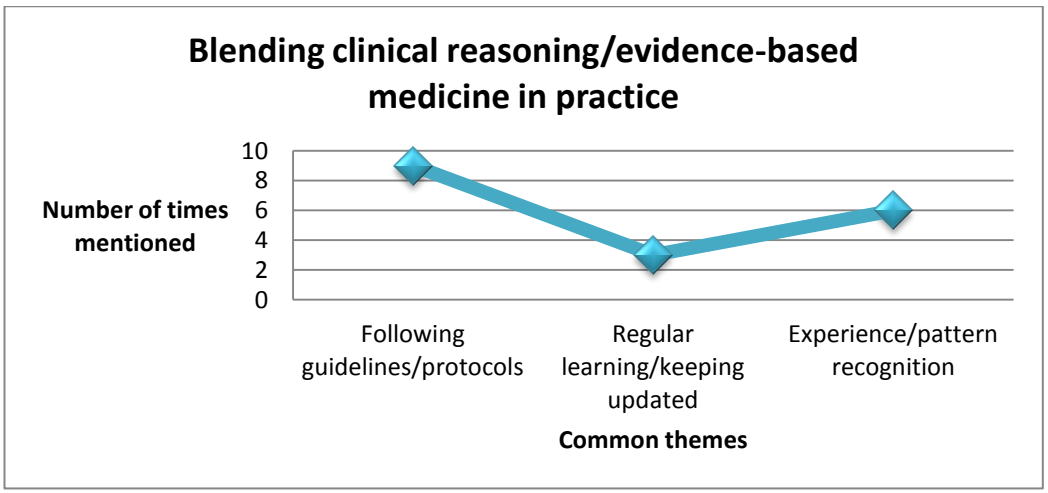


Chart 5.14 – Physicians' views on blending clinical reasoning with evidence-based medicine in practice.

This is shown by the following interview narratives from junior physicians. The responses show that junior physicians regard the way in which they are taught from text books is evidence-based. It shows how science has influenced clinical practice by provided a rationale for some diseases. It also shows how evidence-based protocols and guidelines help the junior physicians to blend their clinical practice with evidenced-based medicine in a medical setting:

> *Your clinical reasoning in a way is evidenced-based, you have learnt this stuff because it is in your text books. Physicians have known for years that coughing up green sputum probably means lung infection. Now science has shown us the enzymes that cause it to be green. You know, I like to do it in terms of what I've learnt, sort of signs, symptoms and all that. Protocols we can then trust, I like having them here, I can just click one button and it will show me what the protocol is for this condition, as a junior it is not just a protocol for me it is also education* [Interview P.17].

(long pause) The only evidence-based practice we get while we are here, because I don't read a lot of A and E papers is what we are taught by the department, the evidence, I guess, and to a greater extent this forms the protocols that we get as juniors. So I guess when we are in the training stage our clinical reasoning is still being developed by the protocols we use [Interview P.03].

I guess that they are inter-looped aren't they? I don't know which one I would hold more highly, probably my clinical judgement and my experience. Your experience is based on your clinical work where EBM is based on research; sometimes there is not a lot of research out there about stuff. I think if there is compelling research you follow it. I guess the EBM comes up with curve scores and other scores which you use to help you, but again you go back to your judgement [Interview P.18].

The more senior physicians appeared to be more sceptical when using protocols. Their experience and clinical judgement played a part in how they blended their clinical reasoning with evidenced-based medicine.

Yes, I really, really like evidence-based medicine, what I don't like is people tend to wrap it up into protocols which became the B all and end all, I don't think that medicine is that black and white and there should always be a back door to things that doesn't fit into protocols. I regularly do loads of reading and use EBM in my practice. I do think that protocols restrict you, and that is why I don't like protocols, I know they are based on EBM but they become out of date and that can restrict you, because you can't follow them if they are out of date... or antiquated but usually on

my level you can bypass that, I do try and keep up to date...and yes I am a great supporter [Interview P.02].

I weigh up the info from EBM with my own clinical experience and try and balance the two. If EBM is good will follow the guidelines but if I feel my patient be at risk I may change the management [Interview P.11].

This is difficult. Very often trial data shows that medication /to 'X' will work within 3 hours. So what about the patient who is 4 hours down the line? Clinical reasoning would say it would still be worth a bash but the trial data / EBM / guidelines would never back that [Interview P.21].

An oversight on my part, was that I failed to ask them about the different types of clinical reasoning approaches they used. This is addressed in Chapter 7. However, I did ask them one question regarding clinical reasoning. This question was regarding the Bayesian approach (Chapter 2 and 3) which had been previously observed by Dowie and Elstein (1988) as an approach that could be used by physicians to establish the cause of a patient's illness/disease. The question asked was 'what is your understanding of Bayes Theorem? Their response was interesting. Fifty percent of the physicians had never heard of it and the descriptions by the other physicians were quite sketchy. These were:

The probability of a diagnosis, for example if a certain test is positive or negative. The relationship between two given events [Interview P.19].

Relation to probability. Important in the screening of breast cancer [Interview P.06].

Bayesian, best analogy is essentially...because I come from a background in genetic research...it is basically a likelihood...the best analogy is...if you imagine a landscape full and look at all the other mountains from say a hill, then you move to another hill and do the same [Interview P.21].

Gosh, golly...it is something to do with an outcome being in proportion to the frequency or likelihood of that incidence. For example, diagnosis being in proportion to the incidence [Interview P.08].

My understanding is that you have a problem, you then apply a test to that problem, pre-test probability then define the probability of the patient having the probability of having that disease or illness [Interview P.01].

5.6 Novice and Expert

In Chapter 2. 7.1, I highlighted that a great deal of discussion has taken place regarding the difference between the expert and the novice physician. Due to the fact, that my study included both junior and senior physicians, I thought that it would be useful to explore the interactions that took place between the novice and the expert in developing the skills of clinical reasoning in clinical practice. Within the ED there was a protocol that stated that all the junior physicians would discuss their patient cases with a senior physician. The junior physicians were FY1 (Foundation Year 1) and FY2(Foundation Year 2) and the senior physicians were usually a registrar or consultant. This interaction between the junior and senior physicians showed the clinical reasoning undertaken by the

junior physician and how the senior physician helped to develop the juniors' clinical reasoning and experience. I have used the analysis of taped discussions that took place between Junior and Senior Physicians following the medical assessment of some of the patients who consented to take part in the study to show the thought processes/ reasoning involved. At the end of each case, I have given my interpretation of the interaction and its rationale.

(1). Patient's Presenting Complaint – painful left shoulder/arm and fast heart beat.

Junior: *Patient woke up complaining of left shoulder/arm pain at 3am this morning, aware of fast heart beat, past med history of atrial fibrillation, non insulin diabetic. She's well, not been having shortness of breath, no other symptoms, wasn't pale or clammy, but pain is still there. She is running along at 130 fast AF has had a small vaginal abscess for 2 or 3 days which has discharged this am, small area of redness in that area.*

Senior : *Did she come in with that?*

Junior: *No she came in with shoulder pain, fast heart rate, she's sort of fairly well and lives independently. If she has a cup of tea and less pain after 6 hrs can I put the fast pulse down to the infection?*

Senior: *I think so, there is one thing I just want to show you (ECG) in terms of localised ischemia she is elderly therefore her heart rate would be faster anyway, which you need to recognise. However, it is a lot faster than normal, which we can probably attribute to the infection* [P.03/P.02].

The junior physician told the senior physician that he felt that the patient's fast heart rate which was probably due to an infection, and the senior physician agreed, but in doing so, pointed out, that as the patient was elderly she would have a faster heart rate anyway. This showed that the senior physician used this discussion to teach the junior physician to be aware of normal biomedical values, such as; normal heart rate in the elderly patient.

(2). Patient's Presenting Complaint – dizziness.

Junior: *Ok…79 year old lady who has been dizzy, particularly bad today. Woke this morning, lightheaded standing up, relieved by sitting down. Lasted about 15 minutes, felt quite hot and clammy. No warning signs. She had a similar turn 2 years ago when the doctor changed her medication for blood pressure. Nothing changed recently. B/P ok, not been unwell recently. Past medical history, she has had two knee replacements also has osteoarthritis in her back. Lives alone in a warden control flat, copes independently. Apparently she looked pretty awful in the ambulance.*

Senior: *So when she woke up she wasn't feeling dizzy? It was just on standing up? OK, so how long did it last for?*

Junior: *She said it lasted until she got to the toilet and she sat down and then again when she went to the kitchen had another episode.*

Senior: *So what do you think is going on?*

Junior: *It sounds like postural hypotension*

Senior: *It could be postural hypotension that she is not recovering from*

Junior: *Ok... yes*

Senior: *So normally the heart would increase the blood pressure, so that could be one thing, couldn't it? She's not had any chest pain, has she? Is she diabetic?*

Junior: *No.*

Senior: *So what are you going to do?*

Junior: *Bloods? (laughs together)*

Senior: *Get her old ECGs.*

Junior: *Then I guess, she is not feeling great so can't send her home.*

Senior: *So get a lying and standing blood pressure, see if she is dropping when standing up. And a significant drop which is a need for her to see the medics and also U and E*[43]*s are needed. She probably needs to stay in. It sounds all simple and postural doesn't it, but she lives alone and is symptomatic need to refer MAU (Medical Assessment Unit).*

Junior: *Ok* [P.04/P.01].

In this case, the junior physician felt that the patient had postural hypotension.[44] The senior physician asked some further questions, such as; did the patient have any chest pain or diabetes. The junior physicians answered no. The senior physician then agreed that the junior physician's impression was probably right, but suggested that the junior physician should check the patient's lying and standing blood pressure to support her finding *(If it was postural hypotension the patients lying and standing blood pressure would be different).*

[43] Us & Es – Urea and electrolyte blood test.
[44] Postural hypotension - blood pressure that drops when standing up.

(3). Patient's Presenting Complaint – abdominal pain.

Junior: *So he has come in with severe abdominal pain, which he describes as up here and down his side* (points to abdomen)*. Similar pain two weeks ago and was given some antibiotics, GP did bloods diagnosed him with gallstones, now when I have examined he has got no pain at all, after having morphine and Entonox in the ambulance.*

Senior: *Why was the GP treating him with antibiotics, if he suspected gallstones? Unless he suspected it was cholangitis or urinary tract infection – did a dip stick, that would make sense.*

Junior: *Ok, that's renal colic and he is describing pain up here.*

Senior: *And flank pain. Ok... any pain in his groin?*

Junior: *No.*

Senior: *Type of pain?*

Junior: *It was sharp, 8/10.*

Senior: *Has he had it constant?*

Junior: *No, he has been pain free for a week until today, woke him up at 7.30am today.*

Senior: *Has he had a dip stick?*

Junior: *No.*

Senior: *So we need a dip stick. He has been on antibiotics, so it will probably give you a completely clear result but if there is blood in there. So, the pain is sharp, does it change has he moves around?*

Junior: *Yes, when he gets up.*

Senior: *So, could this be related to the chest? So, anything on the chest? Any cough or cold?*

Junior: *I haven't asked him about a cough or cold.*

Senior: *Ok, ask him those questions.*

So, what is this sharp pain? Is it linked to the abdomen, sometimes it is easier to work your way down...up here above the diaphragm or below. Is it the liver, bladder, the whole biliary tract. Are his bowels ok? Weight loss?

So if you work your way downwards, chest, lungs, abdomen...sometimes there are so many things that could cause a sharp pain. Check bloods etc. Sometimes cases are so complicated that the only way to handle them is to work through a process, so that you can say you have done this, that and the other...Like a detective [P04/P.06].

This case showed the uncertainty the physicians faced with the obscure cases. In this case, the patient had presented with abdominal pain. The experience physician admitted to the junior physician that they needed to use a process of elimination to find its probable cause. The senior physician recommended to the junior physician a process to follow and referred to this process as being like a detective.

(4). Patient's Presenting Complaint – abdominal and back pain.

Junior: *I have a 74 yr old who has had a cystectomy*[45] *two years ago and a (R)nephrectomy*[46] *in the last year for cancer.*

Senior: *Which cancer?*

[45] Cystectomy – bladder removed.
[46] Nephrectomy – kidney removed.

Junior: *Bladder cancer and the surgeons have told him there is not much more they can do he is now under the care of Dr X, and is having test on Monday to see if his left kidney is alright... that's the background. He presents with 24 hr (R) flank, (R) IF pain, initially a grumble, colicky pain but in the early hours of this morning became 9/10 and unbearable. On examination that is the only finding but his urine dip is positive to leucocytes and blood...so I think we should probably treat him for a urinary tract infection(UTI), I also think I should phone the urologist or the surgeons and let the oncologists know.*

Senior: *What do you want from them?*

Junior: *I just want to make sure that they are happy and there is nothing else they want to investigate. So I think bearing in mind his urine dip it is reasonable to treat for UTI.*

Senior: *OK...so he has been told from his cancer perspective they cannot do anymore and go any further so he is under oncology...so this pain now is a pain he has not had before, and we are finding some urine signs which may account for it. What did you think about his tummy? Surgical abdomen?*

Junior: *It is firm, lots of previous scarring, so I can't feel any masses but it is certainly tender in (R) flank and RIF.*

Senior: *So he has had previously surgery on his stomach which is where he has had is urostomy etc...Has he had his appendix out...or has he still got his appendix?*

Junior: *I don't know.*

Senior: *What you have got to ask...is, is this completely different. If someone comes in with a chronic problem like this it is either his existing*

problem or if on a lot of drugs, it is the drugs causing problems or it is a completely different topic. Infection could be respiratory or urine...but it can be other stuff as well, so as a differential I imagine that putting urological infection thing first on top...That sounds plausible given what we found, but it is possible that it could be something else as well. I think what the surgeons would be helpful for is to make sure there is nothing else that they would take any further.

A discussion then took place regarding which antibiotics to use [P.08/P.12].

In this case, the junior physician felt that the patient had a urinary tract infection, owing to a positive urine test. The senior physician agreed with this impression, but asked the junior physician some further questions, such as; had the patient had his appendix removed. The junior had not even asked the patient this question. The senior physician pointed out that in a case of a patient presenting with an acute complaint on top of a chronic condition it was important to ask the patient if he has any signs and symptoms he has not had before. He also pointed out that in chronic conditions the patient is usually on a lot of medication and that the junior physician needed to take all of this into account.

(5). Patient's Presenting Complaint – abdominal pain.

Junior: *She has had abdominal pain last three days across the whole of her stomach gradually worsening.*

Senior: *Before you start have you had a urine dip?*

Junior: *Yes, had a urine dip, she is pregnant.*

Senior*: Cool.*

Junior: *But she doesn't know it yet.*

Pain goes down to both groins, stabbing in nature and worse on movement. Had oramorphine. No PV loss or bleeding.

Senior: *Right so she has lower abdominal pain.*

Junior: *Well it was worse in the iliac fossa when I pressed it.*

Senior: *What pain killers has she had?*

Junior: *We have given her some oramorphine.*

Senior: *And paracetamol?*

Junior: *Yes she has had paracetamol with us as well.*

Senior*: So the plan is to get her more comfortable and see how she does. She will need a Early Pregnancy Clinic appointment. Are you happy that it is not appendicitis?*

Junior looked uncertainly at senior.

Senior: *Do you want me to come and examine her?*

Junior: *[laughs] Yes please.*

Senior: *OK, alright then* [nice and supportive] [P.04/P.02].

In this discussion, the junior physician had not formed an impression of what she thought was wrong with the patient. She had discovered that the patient was pregnant (although the patient did not know). The senior physician was very supportive of the junior physician and examined the patient himself. Following the examination:

Senior: *See when next scan appointment is. Do FBC*[47]*, Us and Es, Group and save, Beta HCG etc. See how she is in about an hour's time, if she is comfortable enough to go home she can go.*

Junior: *Discharge her?*

[47] FBC – Full blood count blood test.

Senior: *Yes we are not set up to deal with her here; she is not bleeding, cardio-vascularly stable so she can await her scan at home. You tell them to come back if she gets more pain she can go home with analgesia, if it gets worse you tell them to come straight back, occasionally they do and occasionally they come back crashing, but if you have done a group and save and a beta hcg all those bits and pieces you are ready. Alright?*

Junior: *Yes* [P.04/P.02].

The patient was referred to the Early Pregnancy Clinic.

(6). Patient's Presenting Complaint – chest pain.

Senior: *Just summarise.*

Junior: *She was alright until this morning when she bent over to pick up something, pain in chest, epigastric, sharp on deep inspiration, radiates to back, rest of history given as above.*

Senior: *Does she look pale and sweaty?*

Junior: *No.*

Senior: *Does she look unwell?*

Junior: *No.*

Senior: *It doesn't sound like a PE, because a PE doesn't start when you bend over.* You don't think she has any clinical signs of a DVT?

Junior: *No.*

Senior: *It could cardiac or epigastric, and she is saying that it got better with GTN other things like oesophageal problems can get better with GTN*

If you have got epigastric tenderness, I would get an erect chest x-ray, do some bloods.

Junior: *Ok.*

Senior: *Has she had any problems like gallstones?*

Junior: *I didn't ask specifically.*

Senior: *Ok. So may be worth doing LFTs and give her painkillers, so needs to be pain free, she is not eligible for the low chest pain pathway, so she either..she' s coming in under medics. TROP* [P.04/P.07].

In this discussion the junior physician and senior physician are working through the process together. The junior physician has presented the case, and the senior physician is giving his impression of what could be wrong with the patient based on her clinical evidence. The senior asked the junior physician to take some bloods for a liver function test. The conclusive blood test for proving or disproving a heart attack was also requested.

(7). Patient's Presenting Complaint - lightheaded

Senior*: When you're ready.*

Junior*: Came in feeling lightheaded, similar episode yesterday, passed after 1 hr lying down, and never had anything like this before.*

Senior*: So she had a similar episode yesterday?*

Junior: *Yes, I can't find anything infective but she is still feeling quite dizzy. I have done a lying and standing blood pressure which is ok, she says she feels worse when she stands up.*

Senior: *What does dizziness mean? Feeling faint? Room spinning?*

Junior: *Lightheaded.*

Senior: *So no reason for feeling lightheaded, she's 39? Yes?*

Junior: *Yes, past history she has had some musculoskeletal pain, I can't find anything exciting on examination.*

Senior: *What other investigation haven't been done yet by the looks of things?*

Junior: *Sugar?*

Senior: *Got to be in there. Slightly unusual in a 39 yr old, but she is of childbearing age, it is bit of a knee jerk..but it is something we ought to do*

Senior: *We have done ECG, there is sort of right bundle branch block, she is not short of breath is she?*

Junior: *No.*

Senior: *So just dizziness?*

Junior: *Should I do her electrolytes?*

Senior*: It might be worth doing bloods, you might find that she is anaemic, you can get that from a venous gas. What does she think is going on?*

Junior: *She wants to go home to bed.*

Senior: *You can get a venous gas on her and check her potassium, I don't think you need to do anything more. She is normally fit and well isn't she? On any medication?*

Junior: *On clevan.*

Senior: *Has she been on that long? Not been altered recently?*

Junior: *No.*

Senior: *OK, where is she?* [P.04/P.12].

This discussion is an example of the clinical reasoning process taken in a complex case. It shows the process of probabilistic reasoning.

(8). Patient's Presenting Complaint - headache

Junior: *He has had IM Benpen with medics on base.*

Senior: *What was his temperature?*

Junior: *It was 38.6 with paramedics, and now he has had paracetamol. We are going to get a CTscan of his head for LP purposes.*

Senior: *any other signs and symptoms besides his pyrexia? Neck stiffness? Kernigs sign?*

Junior: *I need to check that.*

Senior: *Not sure that you need to do a CT scan if other signs are not there. Need to follow guidelines. We have already started the treatment for meningitis anyway* [P.08/P.10].

Note - recording difficult to hear – a lot of background noise.

In this discussion, the junior and senior were reviewing the patient's treatment. The patient's working diagnosis was suspected Meningitis, so the physicians

were treating this before getting a confirmed diagnosis. They were following guidelines.

(9). Patient's Presenting Complaint – visible blood in urine

A discussion took place after the medical student had seen the patient and before the Staff Grade went to see him. The medical student presented the case.

Med student: *80 year old man with 24 hour history of peeing bright red blood, no pain associated with it. Bright red blood, no sepsis, No abdominal pain, but diarrhoea over last 24hours. I asked him if he had any light-headiness, but he said no, although he did have a fall in November.*

Medical student: *Anything else you want to know about him?*

Staff grade: *Carry on.*

Medication discussed. No relevant family history.

Medical student: *I'll move on to examination – he had a P 77 and B/P178/98 which is high for him usually around 150. RR 16. Sats 92% on air.*

Lungs were clear, bilateral chest expansion, normal heart sounds. On examination of his abdomen he has lost a lot of weight in the last 3 years because of gastrectomy. Lots of scars (medical student explained where to staff grade)*.Tenderness over bladder, pain radiates to penis. Nodular liver, normal bowel sounds. No DVT.*

Medical student: *So my impression – I suspect bladder cancer.*

Staff Grade: *Where do you think the bleeding is from?*

Medical student: *Either prostate or stomach cancer.*

Staff Grade: *How is the stomach causing haematuria?*

Medical Student: *Stomach cancer metastases to bladder cancer.*

Staff Grade: *Anything else?*

Medical Student: *He could have kidney problems, polynephritis, could that cause bleeding?*

Staff Grade: *Yes.*

Medical Student: *Renal calculi?*

Staff Grade: *He hasn't got any pain or temperature?*

Medical student: *Could be infiltration of prostate into bladder.*

Staff Grade:*So what are you going to do?*

Medical Student: *I would like to do a urine dip stick first. Full blood count, UandEs LFTS as well, and suppose if you were worried about infection you could take a mid stream urine.*

Staff Grade: *Would you do bloods for infection?*

Medical student: *If he was septic, yes.*

Medical student: *For other investigations, you could do an abdominal x-ray, but they only do for bowel obstruction, don't they?*

Staff Grade: *So why did you say it?*

Medical student: *He could have a bladder mass.*

Staff Grade: *No they only do it for bowel obstruction.*

Medical Student: *Bladder ultrasound, cystoscopy.*

Staff Grade:*Yes that's good. You could also do cytology* [P.22/P.09].

This discussion showed that the medical student undertook the same medical diagnostic process as the qualified physicians. The dialogue showed that his/her clinical reasoning skills were based on the patient's presenting

complaint, medical history, observations and clinical examination and his/her interpretation using his/her biomedical/pathophysiological knowledge.

These interactions between the novice and the expert have shown that experiential learning was taking place within the ED. This is discussed further in Chapter 6.

5.7 Professional judgement when forming a medical diagnosis?

Experience is seen to play a vital part in the way in which the physicians develop their professional judgement. This is supported by the responses given by physicians when asked at their interviews; does your professional judgement affect making a diagnosis? it was interesting to see the confident way in which the junior physicians with six-months - two-and-a-half years experience responded:

> *I have already learnt from experiences. Appreciate classical patient presentation* [Interview P.04].
>
> *Yes, only been a doctor for two years but common presentations and pattern recognition already important* [Interview P.21].
>
> *Yes, 'gut instinct' and experience counts* [Interview P.19].

The following interview narrative shows how a junior physician appreciates the learning opportunities provided to him, from working in the ED:

> *I have only been doing it for 6 months, but yes of course it does already. If I can digress slightly. One of the lovely things about the emergency department is that there are so many patients, which means that every*

patient I see, I can discuss with somebody, which is a brilliant opportunity. Every discussion is a learning opportunity, so already I am forming judgements. A head injury, for example, I am a bit clearer now from when i came here as to what might indicate that it is more serious; a intercranial bleed is a possibility. I will ask about headache and depending on the nature of their responses, I will judge whether I think that a bleed is likely. If someone bangs their head they are going to have a headache, but it is widespread, when it comes on, or it is localised tenderness where they banged it. So yes, I am exercising professional judgement [Interview P.08].

The senior physicians acknowledged how their experience played an important part in their professional judgement:

Yes, I use my experience for both decision making and making diagnosis [Interview P.11].

As a doctor I am trained to a certain standard to make certain decisions, where if you are trained at a different level, nursing or medical student, then you wouldn't be coming to the same clinical decisions as I do, there are other things too, like type of training and experience [Interview P.02].

Yes, pattern recognition. Having experience makes you confident [Interview P.13].

One of the senior consultants explained to me what he thought the difference was between the experience physician and the novice when forming a diagnosis:

It plays a huge part, if what you are getting at is professional experience influencing diagnosis. The difference between experienced physician and novice is great. You know, some experiences you cannot read them from text books, you are constantly making associations with what you know or have seen before. If you have a very difficult case for instance, you think have you seen it before or something similar, pattern recognition. You do recognise because medicine is not an exact science. It is not 2+2=4. You may have someone who has had a heart attack with different symptoms from the standard textbook, your experience understand this but a novice doesn't [Interview P.10].

Professional judgement is seen to be linked to pattern recognition in diagnosis and the use of tacit knowledge. However, as mentioned previously in Chapter 2.4, the prevalence of diagnostic errors rate is worryingly high.

5.8 The right diagnosis?

To establish a physician's point of view regarding the prevalence of errors made when diagnosing the cause of a patients illness/disease, I asked them 'what percentage of patients are given the right diagnosis? Their responses were interesting, although not very reassuring.

Hopefully lots, but really don't know [Interview P.04].

Hopefully most. 90%? [Interview P.06].

70%? [Interviews P.16 and P.19].

ED – Majors 60%. Minors, not sure [Interview P.21].

In ED? I don't know. I think it is shockingly low, something like half [Interview P.14].

The following interview narrative points out a physician view on the different use of terminology regarding diagnosis. He felt that my questions should have been 'how many patients are given the wrong diagnosis?' He goes on to suggest that not many patients get given a definitive diagnosis.

> *You should really ask the question...how many are given the wrong diagnosis. Right diagnosis is a funny term. I'd like to think...are you going to tie me down to a percentage? I think for a definitive diagnosis not many but probably around 50%. The right diagnosis, I think we may be a bit better at...we don't always make a diagnosis we usually come up with a symptom complex or list of symptoms which may be several diagnoses and form an impression. A definitive diagnosis ...we often discharge people without making any diagnosis at all* [Interview P.02].

Another physician points out that in the ED it is not essential to have a diagnosis. This is due to patients being admitted awaiting test results, further tests or investigations that will inform the diagnostic process:

> *In ED, probably about 50/50.I don't think it is higher because I personally don't worry so much about diagnosis or I guess treating the physiology. It is funny when you see the juniors really getting stuck on the fact they really do not know what is wrong with the patient, whereas I am quite happy not to. I have seen that they are short of breath which could be a chest infection and heart failure, so I will treat the chest infection but the heart failure may still remain and I transfer them to a ward without a label on them. Whereas I imagine when you get into surgery or medicine the*

percentage would be a lot higher 80 to 90% as by then they have got the blood results back that we may not have got down here. A CT scan that we didn't request because it wasn't urgent, so they have got more investigation to confirm the diagnosis, whereas we are lucky if we have got X-rays and bloods and maybe a CT scan before they leave us. Unless they are really sick and cannot be moved anywhere. Some blood tests you have to wait 6 hours or longer [Interview P.18].

A view given by one of the medical students was a lot more optimistic!

In the ED I would say about 98 to 99% of the patients that have an important acute diagnosis required, will get their diagnosis. The rest of the patients...ED works as a triage, you decide this is a medical condition and send them to a medical physician who has more knowledge. From what I have seen it is very high [Interview P.17].

I feel that this point of view reflects the operational process and management of patients within the ED rather than the level of accuracy in the actual diagnosing of the patients. The medical student has observed patients with life threatening problems being given an impression/working diagnosis and then being treated accordingly. He has also acknowledged the way in which ED transfers patients to other areas for further investigation.

5.8.1 How do you know that the diagnosis you have made is the right one?

The interview narratives in response to this question showed that ED physicians do not know if their diagnosis was correct. This appeared to be due to the clinical setting of an emergency department where patients are either admitted

or transferred to another ward or department. These responses correspond with the views given in 5.8.

> *You don't ! Especially in ED* [Interview P.04].

> *Very difficult to ascertain as in ED, see them, then either admitted or go home, so you don't get feedback to know if you were correct* [Interview P.11].

> *Sometimes you don't. Sometimes you never know. It is difficult in ED as it is up to you to follow patients once they are admitted. Much easier working in the wards* [Interview P.06].

> *Try and come up with a list of differential diagnoses of which one should be right, and hopefully a investigative strategy to prove it is right* [Interview P.14].

> *On the basis of probability* [Interview P.01].

In some cases the diagnosis given is confirmed by the response to treatment given or the result of a simple test which had been carried out in the ED. For example, in the case of the diagnosis of a chest infection, confirmation is given by the result of a chest x-ray. In the case of a suspected fracture of a limb, an x-ray confirms that the limb is not broken:

> *Patient recovers with treatment* [Interview P.16].

> *You don't always know the diagnosis but have a list of differentials to include or exclude with investigations etc. Sometimes the diagnosis is obvious immediately from a simple test done in ED* [Interview P.19].

Either the patient improves instantly with treatment I have given and trust the investigations and its findings to give the correct diagnosis. You use what signs and symptoms found to back it up or not, with investigations plus feedback from GPs or inpatient teams [Interview P.11].

The interview narratives show that it is difficult for physicians to verify the impression/working diagnosis they have given. Patients are transferred to other wards or discharged to the care of their GPs:

You don't very often know. In ED patients move on before response to treatment occurs. In interesting cases, it's prudent to follow up the patients discharge letters etc. To see what happened [Interview P.21].

In 5.6, I showed how junior physicians sought validation from senior physicians regarding the clinical reasoning they had used and the impression/working diagnosis they had formed. This is also shown in the following interview narrative:

Um, I guess partly from validation from your seniors, if you discuss it with them and they agree with your diagnosis and management plan. Maybe feedback from re-presentation, if patient comes back in later, it gets fed back to you by the physician who sees them the second time, if you have mis-diagnosed or missed something on the x-ray [Interview P.03].

Another point made within the interview narratives was whether you had to have a definitive diagnosis if the treatment and management of the patients was the same as for a different diagnosis. This scenario is given below:

> *You don't always know. For instance a patient I saw yesterday, I diagnosed with cholescystitis*[48] *but when the surgeon came he said biliary colic, which is a stone causing the pain, but it doesn't really matter as both are diagnoses which were very close and the investigations are the same, so which one of us is right will be determined* [Interview P.08].

It is acknowledge that within an ED the conclusive diagnosis is not always established prior to the patient being admitted into an inpatient bed or discharged. A further study within the inpatient wards or with the patients' GP would be required to ascertain the level of diagnostic accuracy.

5.9 Concluding comments

Clinical reasoning is difficult to define. It concerns how physicians gather their patient information and then use that information to discover the probable cause of a patient's presenting complaint. This chapter has shown the clinical reasoning approaches taken by physicians when forming their impression/working diagnosis. Building on Chapter 4, I have explored the medical diagnostic step process and shown how interdependent clinical reasoning is with those steps. This chapter focused on the patient/physicians interaction and the part that played in gathering information; the physical examination of the patient and observations recorded in the medical notes. It has also provided an insight into the interaction between junior and senior physicians and the role that it plays in building clinical experience and knowledge.

The findings were:

[48] Cholescystitis – inflammation of the gall bladder.

- Combinations of clinical reasoning approaches were used by the physicians when forming a medical diagnosis, as to the probable cause of a patient's presenting complaint.

- The causal inferences made by the physicians during the clinical reasoning process were based on their biomedical/pathophysiological/empirical knowledge.

- The individuality of patients created medical uncertainty.

- In the majority of cases the impression/working diagnosis of the cause of the patient's presenting complaint formed by the physician was based on probability.

- The clinical reasoning used by the physician was not always transparent in practice or evidenced in the medical notes.

- Experiential learning took place in the ED based on an ED protocol.

- Senior physicians formed their impression/working diagnosis quicker than junior physicians.

- The recorded medical notes made by the senior physicians were more parsimonious.

- Evidence-based medicine was valued by the physicians although senior physicians were more sceptical of the use of protocols underpinned by Evidence Based Medicine in clinical practice.

- An impression/working diagnosis was made in the ED rather than a conclusive diagnosis.

In the next chapter, Chapter 6, I discuss these findings and the findings set out in Chapter 4. This discussion provides a overall picture of how the physicians in my study formed their impression/working diagnosis of the probable cause of a patient’s presenting complaint.

Chapter 6 – Discussion

6.1 Introduction

In this, the last chapter in which I report on the data, I discuss the social processes and individual clinical reasoning that underlies causal attribution when physicians form a medical diagnosis. Whilst the research on which this thesis is based touches three sociological levels, mircro, meso, macro, I mainly concentrate on the microsociological level involving the analysis of the person and personal interactions (Smelser 1997). This discussion relates to the findings shown in Chapters 4 and 5, linked to the theoretical context outlined in Chapter 2 and to other studies.

My study has shown that the social process of the medical encounter involves an interaction between the physician and the patient (Chapter 4.4.1). Physicians used this interaction to gather information from patients[49]. The gathering of information was gained through the use of taught sequential steps (Chapter 4.3) The next part of the process was found to be the use of this gathered information through the physician's clinical reasoning leading to the formation of a diagnosis[50]. Clinical reasoning was used to identify the probable cause of the patient's presenting complaint (Chapter 5.2).

[49] The ethical restrictions placed on my study, meant that all the patients in my study were able to give their own informed consent. They therefore took part fully in this interaction. Had my study included patient's unable to give their informed consent, the physician would have had to consult with the patients' carers and the patients' GP to gather this information.

[50] In the ED, the diagnosis was referred to as an impression/working diagnosis.

Although the study indicated that this standardised process was consistent, I found that the amount of information gathered and the clinical reasoning undertaken by physicians varied according to the patient's presenting complaint. This was shown to be more evident in cases of uncertainty, where the physicians were unsure about the cause of the patient's presenting complaint. The findings showed that this uncertainty was heightened by the individualism of each patient in relation to their presenting complaint. This was highlighted in Chapter 5.2.1, through the findings of the analysed case-based clinical evidence recorded in the patients' medical notes. In several cases, the recorded clinical evidence of causal conditions was limited and these cases made it difficult to provide an explanation of how physicians attributed the probable cause of the patient's presenting complaint. In cases where the clinical evidence was more transparent, it was easier to provide a probable explanation.

6.2 Science and art in medicine

Previously, in Chapter 2.1, I showed how scientific advancements have informed the scientific view of medicine. This led to some physicians feeling that these advancements threatened the art of their clinical practice. This leads to an ongoing debate about whether medicine is a science, an art or both (Chapter 2.2). My study shows that the science and the art of medicine were used interdependently by physicians when forming a medical diagnosis about the cause of a patient's presenting complaint. I found that the physicians used their scientific biomedical and pathophysiological knowledge when gathering information (Chapter 4.4.2) through the content of the questions they posed to their patients and their art was expressed in the way in which the questions

were asked. A combination of scientific/empirical and tacit knowledge informed their clinical reasoning (Chapter 5.2). This finding supports the suggestion by Saunders (2000: 18): ‘Knowing is an art, science requires personal participation in knowledge’.

Empirical knowledge was gained through experiential learning between junior and senior physicians and the use of evidence-based medicine in the form of guidelines and protocols. However, although evidence-based medicine was regarded as important by all the physicians (Chapter 5.5. Chart 5.13) there was some scepticism voiced by the senior physicians. This scepticism concerned the restrictions placed on their clinical practice (Chapter 5.7). The senior physicians tacit knowledge based on previous experience and scientific knowledge meant that they preferred to have the freedom to decide how and when they used evidenced-based medicine. Shaughnessy et al (1998: 425) suggest that implicit knowledge of clinical experience is largely comprised of tacit knowledge and known as ‘knowing practice’.

6.2.1 The gaining and use of knowledge

As previously mentioned, my study has shown that the use of biomedical, pathophysiological, empirical and tacit knowledge underpinned the social process of the physician trying to identify the cause of a patient’s presenting complaint. This biomedical and pathophysiological knowledge was gained at medical school. As Woods (2007:1173) argues medical education has recognised the importance of linking biomedical knowledge with clinical facts:

> Recent work suggests that biomedical knowledge can help novices develop a coherent and stable mental representation of disease categories. As a result, learners are able to retain clinical knowledge over time and maintain diagnostic accuracy when faced with clinical challenges. This suggests that clinical teachers should attempt to make explicit connections between biomedical knowledge and clinical facts during training.

Since the publication of *Tomorrow's Doctors*, problem based learning has been introduced in medical education, this form of training has shifted the emphasis of learning onto the students themselves. This ethos of self directed learning means that they decide on how they will fulfil their learning objectives. The importance of linking biomedical knowledge to clinical facts should be an important part of these learning objectives. In my research, I found physicians' biomedical knowledge relating to abnormal bodily function was useful when physicians were trying to identify the cause of the patient's presenting complaint. This knowledge allowed the physicians to be aware of the relevance of the patients' signs and symptoms (Chapter4.4.2). McPhee and Hammer (2010:1) suggest that 'it is important that students understand normal structure and function, and how they can become disordered, and apply this knowledge to disease'.

In this thesis, I have shown the way in which the physician respondents used their biomedical knowledge when questioning the patients. This questioning was found to follow a similar pattern for both the senior and junior physicians (Chapter 4.4.1). The closed questions were seen to be based on the patient's presenting complaint. However, previous studies have suggested that the way in which biomedical knowledge is used by junior and senior physicians differs.

Previously, studies have been conducted where physicians have been asked to think out loud whilst forming their medical diagnosis. These studies suggested that senior physicians rarely refer to pathophysiological concepts when reasoning about a case, whereas the junior physicians used pathophysiological concepts extensively (Boshuizen, Schmidt and Coughlin 1988, Patel, Evans and Groen1988, all cited by Cuthbert et al (1999).

Boshuizen and Schmidt (1992: 153-84) suggest that 'experts use biomedical knowledge in a tacit way, because in the course of becoming an expert this type of causal knowledge becomes encapsulated into clinical concepts'. They propose three explanations for the difference between experts (senior physicians) and novices (junior physicians). Simply put these are:

- As a physician gains experience in diagnosing patients, biomedical knowledge becomes basic. With detailed knowledge no longer retrievable.
- As the physician gains experience s/he uses clinical reasoning. Therefore their biomedical knowledge becomes static, but is still available and is activated when required.
- Biomedical knowledge may become encapsulated and is integrated in clinical knowledge.

I do not totally support this proposal. I suggest that biomedical/pathophysiological knowledge once learnt is difficult to forget. My findings show that physicians can retrieve detailed information when required, but that the sequential way in which they are taught to question the patients during the medical diagnostic process curtails the need to do so, in a majority of cases. I also propose that the physicians' biomedical knowledge does not become static during their clinical reasoning, as it underpins it. However, I do agree with the view that biomedical knowledge is encapsulated with clinical

knowledge. It is this combination of knowledge that plays an important part in the physicians' pattern recognition. My study has acknowledged that the senior physicians made their clinical decisions quicker than the junior physicians and that the senior physicians recording of medical notes were more parsimonious. I suggest that it is the physicians' empirical knowledge which accounts for this variation. As Saunders (2003) suggests, empirical knowledge in medicine emphasises practical experience and observation over scientific theory.

6.2.2 Experiential learning

As previously mentioned, empirical knowledge was built up in the ED, through experiential learning . A written protocol meant that all the junior physicians had to discuss each of their cases with a senior physician. As shown in Chapter 5.6 empirical knowledge was gained through the discussions that took place between the junior physicians (FY1 and FY2) and the senior physicians (Registrars and Consultants) following the initial medical encounter. (Unless the junior physician had concerns and asked for the senior physician to see the patient sooner).

The narratives from the interaction between junior and senior physicians showed that they were used for verification, reflection and shared problem solving. For example in Chapter 5.6 Case 2, I present a narrative which showed that the senior physician used this interaction to verify that the junior's impression of the probable cause of the patient's presenting complaint was a good interpretation of the information they had gathered. Case 4, provided an example of the senior physicians using the interaction to encourage the junior

physicians to reflect on their actions and to learn from any anomaly. In some cases, the patient's presenting complaint was uncommon. In these cases the interaction between the junior and senior physicians was a shared problem solving exercise and joint learning experience (e.g. Case 6).

Beard and Wilson (2002:2) suggest that 'experiential learning is the sense-making process of active engagement between the inner world of the person and the outer world of the environment'. They show this process as a learning combination lock. With each cog representing elements of experiential learning.

These individual cogs are shown in detail below:

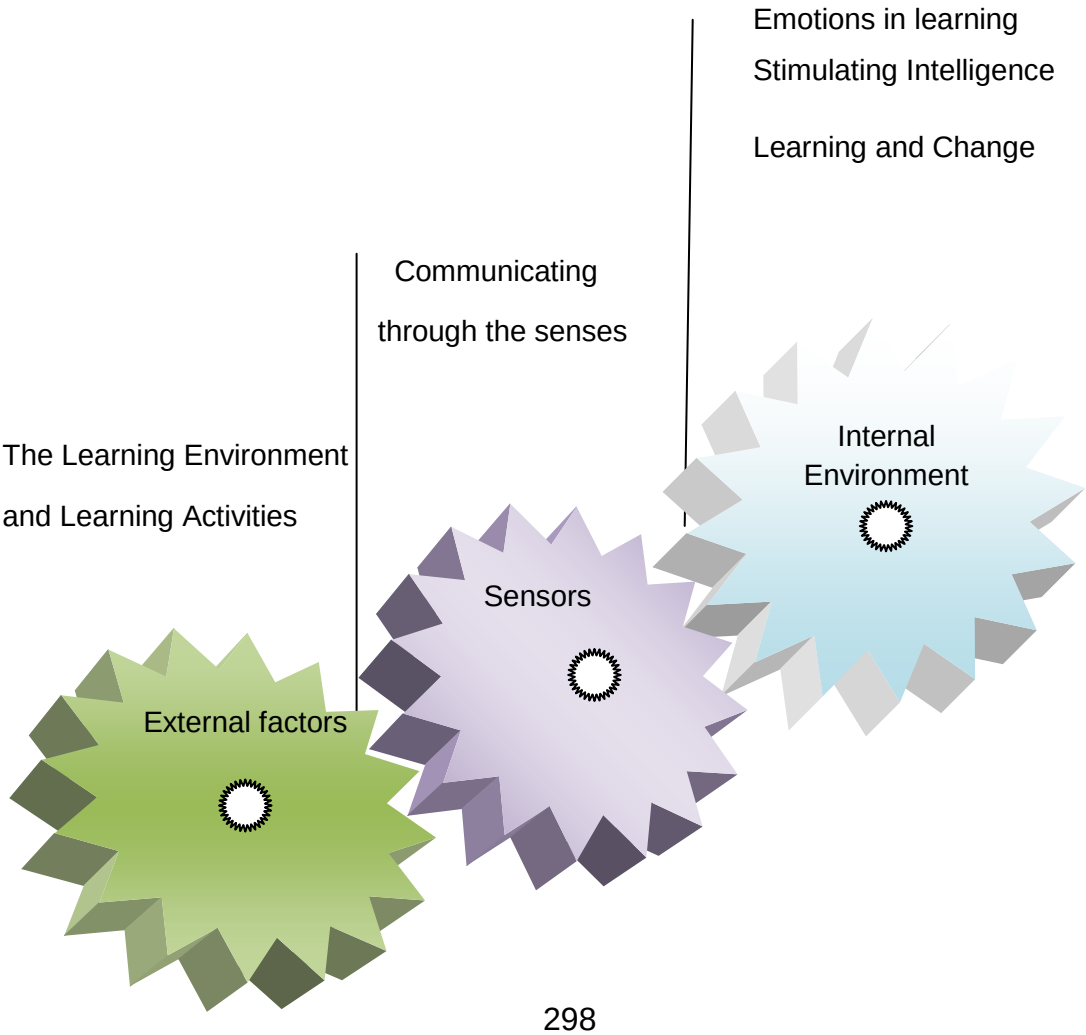


Diagram 6.1 Learning combination lock. Adapted from Beard and Wilson (2002:4) – the learning combination lock. (N.B. I was unable to draw the original diagram, although the content remains unchanged).

Each cog represents different combination factors, which are illustrated in Table 6.2. These combinations have been adapted to reflect my interpretation of how a learning combination lock would look if it were representing how the junior physicians learnt from the senior physicians in the ED.

Table 6.2 - My Interpretation of different factors within the combination lock, if it were appertaining to the ED:

The Learning Environment	**Learning Activities**	**Communicating through the senses**	**Emotions in Learning**	**Stimulating Intelligence**	**Learning and change**
Emergency Department: Majors. Minors.	Challenges. Communication skills. Biomedical knowledge. Collaborative teamwork. Problem solving. Clinical reasoning.	Sight. Hearing. Taste. Smell. Touch. Intuition.	Fear. Incompetence. Failure. Happiness. Hope. Sadness. Frustration.	Logical. Verbal. Bodily. Visual. Spatial. Interpersonal. Scientific.	Planned. Emergent. Activist. Pragmatist. Reflexivity. Concurrent Learning. Prospective learning.

Table 6.2 – Learning environment. Adapted from Beard and Wilson(2002:4)- Just one learning environment used – tailored to ED.

The narratives that we read in Chapter 5.6 showed how the learning activities varied according to the patient case being discussed. The junior physician had the challenge of managing uncertainty. S/he needed to be able to communicate his/her findings to the senior physician in a way that was comprehensive and

clear. This activity required the junior physician to engage with the senior physician using eye contact and listening skills. The juniors used their taught biomedical and pathological knowledge to present the cases. They used their clinical reasoning and problem solving to explain how they had formed the impression/working diagnosis of the probable cause of the patient's presenting complaint.

The way in which the junior physicians presented their case to the senior physicians varied. Some of the junior physicians appeared more confident than others. My fieldwork had commenced at the same time as a number of FY1s were starting their first rotational placement. It was interesting to see the change that took place in their demeanour, as they progressed through their placement. They changed from appearing uncertain and nervous initially, to appearing more confident when presenting their cases. During my observation of the physicians' clinical practice, I witnessed how these discussions subsequently influenced the actions of the junior physicians. I found that when the junior physicians were assessing subsequent patients with the same presenting complaint they would retrieve the knowledge that they had gained during these discussions. This informed their clinical reasoning. This finding is consistent with Needham and Begg (1991) who suggest that 'clinical reasoning is primarily a categorisation task that involves retrieving stored knowledge and then 'fitting' this to a new problem' (cited by Heemskerk et al 2008: 454).

In their five stage model of development from novice to expert, Dreyfus and Dreyfus (1986) describe the novice as starting by using the theoretical knowledge gained during their training in a context free way. Then over a period

of time developing their practice through pattern recognition. As their competence grows they become more experienced:

> The individual practitioner, because of his or her own actions and experiences from a number of similar situations, will gradually become aware of these similarities and thereby able to predict how situations develop. In that way, the practitioner accumulates knowledge of which he or she is not conscious (Dreyfus and Dreyfus 1986, cited by Nielson (2002: 7).

This description fits well with my observations and narrative recordings which showed the development of the junior physicians in the ED (Chapter 5.6). As shown previously in Chapter 5.7 empirical knowledge was also gained through the use of evidenced-based medicine. This was in the form of protocols and guidelines.

6.3 Forming a medical diagnosis

Through the findings set out in Chapters 4 and 5, I have shown that the medical diagnostic step process and clinical reasoning are interdependent. Although the physician respondents attended a range of medical schools, either in the UK or abroad, these steps were found to be a fundamental part of their training (Chapter 4.2.4). In the ED, I observed physicians of different grades and with diverse levels of experience undertaking the same medical diagnostic process. Through the use of the physicians' interview narratives, I found that the use of the sequential steps made the physicians feel comfortable and helped them to manage the uncertainty that is inherent in medicine (Chapter 4.3). This finding is supported by Swoboda (2008: 453), who suggests that:

> Diagnosing physicians manage the uncertainty associated with these illnesses by using strategies that enhance bounded rationality and aid in thinking beyond current disease models. Strategies include consulting ancillary information sources, conducting analytically informed testing, and considering physiological explanations of causation.

The sequential steps were shown to involve gathering information such as: gaining the patient's history, physical examination, observations and investigations.

These steps were followed by the physician using a clinical reasoning approach/es to form a medical diagnosis. The clinical reasoning consisted of the physicians' interpretation of the gathered information.

Diagram 6.2 shows the diagnostic process that took place in the ED:

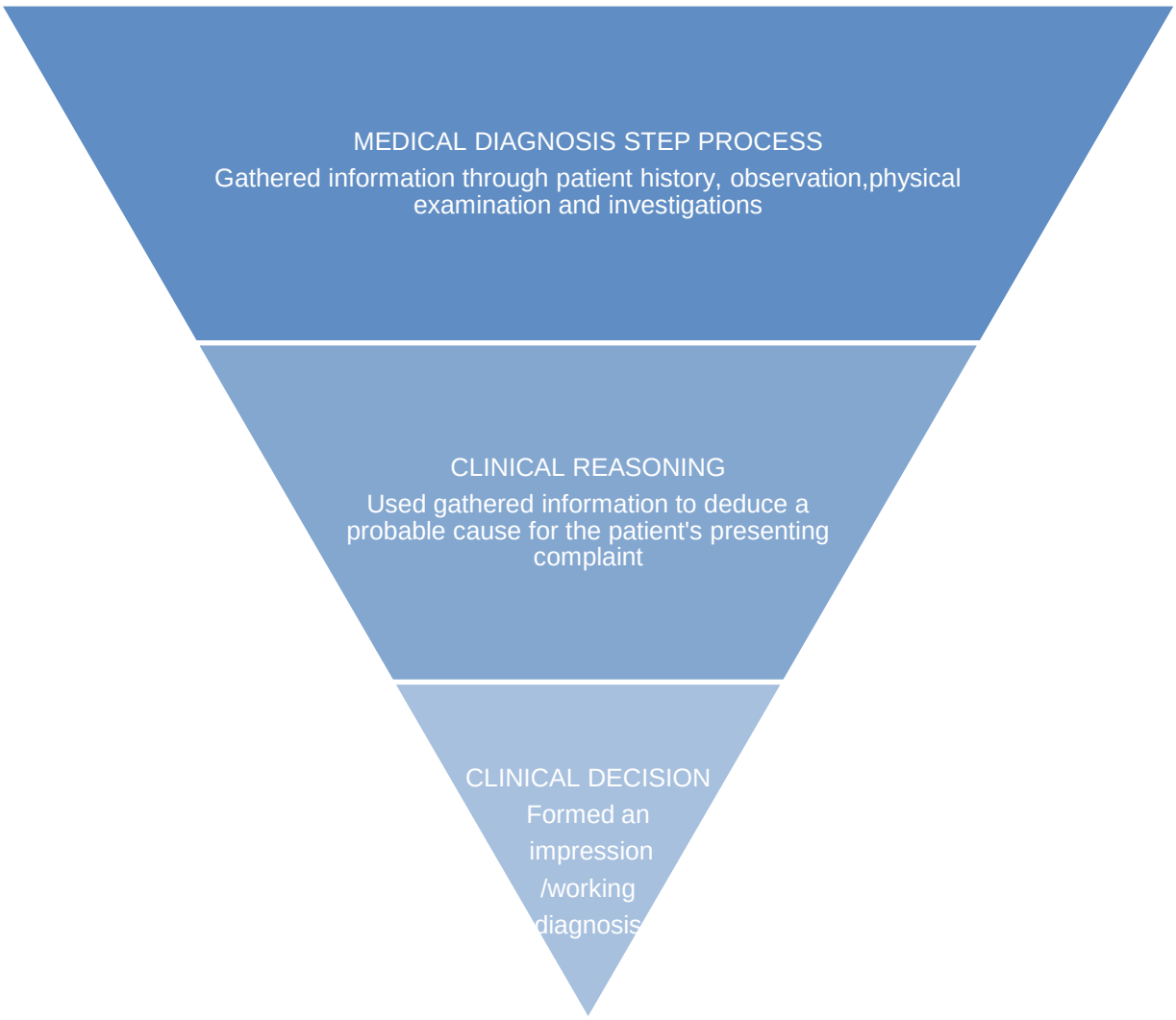


Diagram 6.2 - The diagnostic process that took place leading to the physicians forming their impression/working diagnosis.

These steps concur with the work of Raimondo (2004: 49-60) who suggested that, ‘when discussing the possibility of expressing the medical diagnostic process in a systemic and informational theoretical approach, it could include four steps’. A shortened version of his view is shown below:

> Step 1 - To collect valuable data selecting them from all (raw) data available in the clinical case.
>
> Step 2 - To build up a coherent comprehension of the clinical meaning (that is to say, clinical importance) of gathered valuable data. (This step requires a diagnostician strong sense of, and skill for, differentiation between valuable and non valuable data).
>
> Step 3 - To *build up a coherent comprehension* of what parts of the clinical facts respond to the basic illness and what parts become from compensatory reactions acting as pathological factors modifying, or not, the original clinical case.
>
> Step 4 - Integration of the previous step and integrate the clinical information *to build up* a prognosis on which the physician can base treatment indications, or can develop a strategy

I interpret these steps to match the steps in my model in the following way; Step 1 corresponds to the gathering of information, Steps 2 and 3 corresponds to the clinical reasoning and Step 3 to the clinical decision making.

As previously mentioned, the amount and depth of information gathered and then recorded depended on the patient’s presenting complaint. This was shown to be particularly noticeable in cases where the physician was uncertain as to the cause of the presenting complaint (Chapter 5.2.1.1) compared to cases where the

cause of the presenting complaint was determined by the injury or ailment (Chapter 5.2.1.2). Although all the patients' medical notes recorded patients' histories, in some cases the recorded history was very brief. This brevity was shown to be linked to the type of case and in some instances to the seniority of the physician.

The way in which physicians gained the patients' histories has been clearly illustrated in this study through the use of taped narratives observed and recorded during the medical encounter (Chapter 5.2.1). Through my interpretation/discussion of each case, I have showed how/if I thought that these histories influenced the physicians' clinical reasoning. I found that the way in which the physicians questioned the patients proved to be a key factor. Their routine of starting with an open question, allowed the patient a very short time in which to express their signs and symptoms. Then, by honing in on specific questions relating to his/her first thoughts of the probable cause of the patient's presenting problem, the physician gained information from the patient. These examples showed the importance of the patient/physician interaction and showed the relevance of the patient narrative in the medical diagnostic process and clinical reasoning. This finding substantiates the views expressed previously in Chapter 2.5 regarding the importance of the patients' narrative. As Ramani (2004: 374-376) suggests, 'the patient history is a vital piece of the physician–patient encounter and helps to lead to the final diagnosis about 75% of the time'.

Whilst I agree with this suggestion, I think it is worth noting that in my study, I found that the patients' narratives/history were controlled by the way in which

the physician asked the questions. This is evidenced in Chapter 4.4.3 when looking at the comparison of questions asked by the physician relating to the various presenting complaints. It could be argued that the history gathered from the patient, is only as good as the questions asked by the physician. As already explained, these questions are devised to fit the cause of a patient's presenting complaint to a diagnostic category.

Unfortunately, I did not observe any medical encounter involving patients who were unable to give their own history. As previously mentioned, this was due to the ethical constraints of my study (Chapter 3.4). However, I acknowledge that this would/could have an impact on the way in which information was gathered and the subsequent diagnosis made. When a patient is admitted unconscious, physicians gather their information from other available sources, such as; relatives/carer, ambulance report or will contact the patient's GP to gain some background information. In these cases, the diagnosis is based on 'second-hand 'information.

My study has shown that in addition to gaining the patient's history, other factors such as; physical examination, observations and investigations form part of the medical encounter (Chapter 4.5). A study undertaken by Palchik et al (1990: 107-13) compared the information gathering strategies of medical students and physicians in stimulated medical cases. Their findings suggested that physicians and medical students place a different emphasis on each part of the process. The physicians were seen to place a greater emphasis on the patient's history, while the medical students focused on diagnostic studies. However, I found little evidence that this was the case in the ED. The junior and

senior physicians undertook the same process and did not seem to place a different emphasis on any part of the process. This was substantiated in the physicians' responses when asked how and why they undertake the medical diagnostic process (Chapter 4.4.1). However, as previously acknowledged there was a difference between the senior and junior physicians in the speed with which they undertook the process and the subsequent medical notes recorded.

The physicians' interview narratives showed that through the use of the information gathered - history, physical examination, observations and investigations - they looked for salient clues. These clues were based on the signs and symptoms exhibited by the patient. However, as previously mentioned, there were inconsistencies in the way a physical examination was carried out and the observations recorded in the medical notes. In the cases where the cause of the presenting complaint was uncertain, the physical examination was observed to follow the basic classical techniques (Chapter 2.2). In the cases where the cause of the patient's complaint was determined by the injury or ailment, the physical examination was observed to be of the localised area. Ansell and Hiremath (2001) suggest that there can also be inconsistencies in the way physicians conduct a physical examination and interpret observations (Cook,1990. Eddy,1984). Cook's study found inconsistencies with the clinical assessment of central venous pressure. In a previous study reported on by Eddy (1984) four physicians collected data from 993 coal miners. The number of coal miners reported as having a cough, shortness of breath or producing sputum varied. Eddy (1984: 75) proposed that:

> ...even if there were no uncertainty about what constitutes a disease and how to define it, there would still be considerable uncertainty about whether or not a patient has the signs, symptoms and findings needed to fit the definition.

I suggest that it is this individuality of the patient that adds to the uncertainty inherent in medicine. This was highlighted throughout my findings. The real data used from each individual case, showed that the causal conditions present in some individual cases, were found to be absent of a pattern when compared to other individuals in the same category of impression/working diagnosis (Chapter 5.4). This is discussed further in Section 6.5.

6.4 Clinical Reasoning

My findings regarding clinical reasoning have some commonality with previous clinical reasoning research regarding the role it plays in medical diagnosis (Norman 2005; Higgs and Jones 2000; Elstein et al, 1978; Bursztajn, 1990) (Chapter 2,6). This concerned the clinical reasoning approaches proposed. However, through my study, I have shown that the physicians used a combination of the different clinical reasoning approaches at the same time. I found that all these approaches focused on the same issue; which was the physician trying to discover the probable cause of a patient's presenting complaint. This finding concurs with the combination of approaches suggested by Glass (1996) who felt that making a medical diagnosis is a complex cognitive task that involves both logical reasoning and pattern recognition. In this section, I discuss the different clinical reasoning approaches I witnessed being used within the clinical setting of the ED.

6.4.1 Pattern recognition

The pattern recognition that I witnessed, was said by the physicians to be concerned with the patient's presenting signs and symptoms. As previously mentioned in Chapter 4.4.2, during their training physicians are taught the typical signs and symptoms to expect related to common diseases/conditions/injuries. The questions that the physicians asked the patients were based on this training. Therefore physicians were looking for a pattern of signs and symptoms that s/he recognised and associate with a disease/condition/injury. Chapter 5. 2.1 showed individual cases where this was evident. For example; a patient admitted with the presenting complaint of chest pain was asked questions relating to the type of pain; its location, its duration, activity at the time and if there were any other signs and symptoms. This showed that the physician was trying to match the pattern of the patient's signs and symptoms to his/her learnt knowledge of the common signs and symptoms of a heart attack. The linking of signs and symptoms and pattern recognition has been previously expressed by (Norman et al 1992; Schmidt,1990 and Coderre 2009, for detail see Chapter 2.6.4.2.).

The physicians informed me that through the gathering of information it was the pattern recognition of signs and symptoms which informed the formation of their initial differential diagnosis. I observed that if a patient was showing the common signs and symptoms for 'x' presenting complaint, then it would be assumed that they probably had 'x' wrong with them. This process was disrupted when the patient showed atypical signs and symptoms. These atypical signs and symptoms were either through the way the patient told their

story (history) or the way in which their body had responded to the illness/disease/injury.

An example of this scenario was shown in Case 1 and Case 2 in Chapter 5. 2.1.1. In these two cases, both of the patients mentioned were admitted to the ED with the presenting complaint of chest pain. The patient in Case 1 showed atypical signs and symptoms and was initially thought not to have had a heart attack, but had, had. The patient in Case 2 who showed the classical signs and symptoms for a heart attack was initially thought to have had a heart attack, but had not. These two case studies showed the importance of using a combination of clinical reasoning to inform the diagnostic process. The physical examination of the patient in Case 2 informed the physician of clinical signs of other illness/disease. Therefore there was a probability of different causes for the patient's presenting complaint of chest pain. Eva et al (2007: 1152) carried out a pair of studies looking at the use of a combined approach to clinical reasoning. The studies were undertaken by undergraduate psychology students. The students were trained to diagnose cardiac conditions via ECG (electrocardiogram) presentation. One group were instructed to use combined reasoning to make a diagnosis and the other group were given no explicit instruction on how to form their diagnosis. The result of the study showed greater diagnostic accuracy in the group which used the combined reasoning approach. The researchers suggested that this provided further empirical support for the notion that explicitly telling novice diagnosticians to utilise multiple forms of reasoning, such as; pattern recognition combined with careful consideration of the presenting features can result in improved diagnostic accuracy.

A review undertaken by Geary and Kennedy (2010: 56-60) of the bases for decision making in emergency medicine suggests that:

> ... the process involves more than a simple an action-reaction sequence. instead, decisions are governed by cognitive processes that favor the development of strategies and complex skills that enable the physician to act appropriately. Influential factors include physician related attributes as well as emergency service- and patient-related ones. Two models of clinical reasoning are defined. In the first system, reasoning is instinctive, driven by
> pattern recognition. The ability to make decisions with this system is acquired over time, through experience. In the second system, decision making is systematic and analytical.

Geary and Kennedy (2010) conclude that the systematic/analytical approach is more reliable and less prone to error than pattern recognition.

6.4.2 Hypothetic deductive reasoning

The physicians formed a differential diagnosis (hypothesis) fairly quickly in the ED. They gathered their clues through the gathering of information (Chapter 4) and pattern recognition of the signs and symptoms. In some instances their differential diagnosis comprised of one probable cause of the presenting complaint. In other cases the differential diagnosis could comprise of several probabilities of the cause of the presenting complaint. Where a single probable cause for the presenting complaint was given, the process for reaching the working diagnosis was shorter. In the cases where the cause of the presenting complaint could have several probabilities the process was longer.

The deductive reasoning used to test the hypothesis was likened to ‘detective work’. (Chapter 4.3). Physicians tested his/her hypothesis (his/her assumption)

of what the probable cause of the presenting complaint could be by a process of elimination. This view is supported by the work of Baggini and Fosl (2010:10) who suggest that ‘deduction is the form of reasoning that often emulated in the formulaic drawing room denouements of classic detective fiction’. The physicians made their differential diagnosis and then used physical examination, observations and in some cases investigations to see if their hypothesis was false or could be substantiated. The questions that physicians asked the patients about their signs and symptoms were crucial to the ruling in or out of conditions. For example; in the scenario of a case of a patient with the presenting complaint of abdominal pain, the following questions could be asked:

- Did they have vomiting or diarrhoea?

  Rationale - if not, could probably rule out gastroenteritis
- Any pain or guarding?

  Rationale - if not, could probably rule out appendicitis
- Any temperature?

  Rationale - if not, may be able to rule out an infection
- Any previous surgery?

  Rationale - if not, could rule out adhesions or scarring.
- If female; was the pain gynaecological?

  Rationale – further questioning and tests to rule out pregnancy problems etc.

This deductive reasoning was interrelated with probabilistic reasoning. An example of this was the instance that occurred when a couple of patients were admitted to the ED with abdominal pain with sickness and vomiting. Both of

these patients had eaten the day before in the same establishment. Therefore, it was assumed that they probably had gastroenteritis.

6.4.3 Probabilistic reasoning.

In a majority of the trauma, mechanical falls and ailment cases the cause of the patient's complaint was determined by the injury/ailment. Probabilistic reasoning was used in cases where the cause of the patient's presenting complaint was uncertain. This finding is comparable with previous research carried out by Bursztajn et al (1990) and their diagnostic paradigms (for detail see Chapter 2.6.1.7). However, my diagnostic paradigms have an added dimension (Diagram 6.3). The reason for this was that I found a group of patients who did not fit neatly with either the uncertain or determined causes. These cases were shown in Chapter 5. 2.1.3.

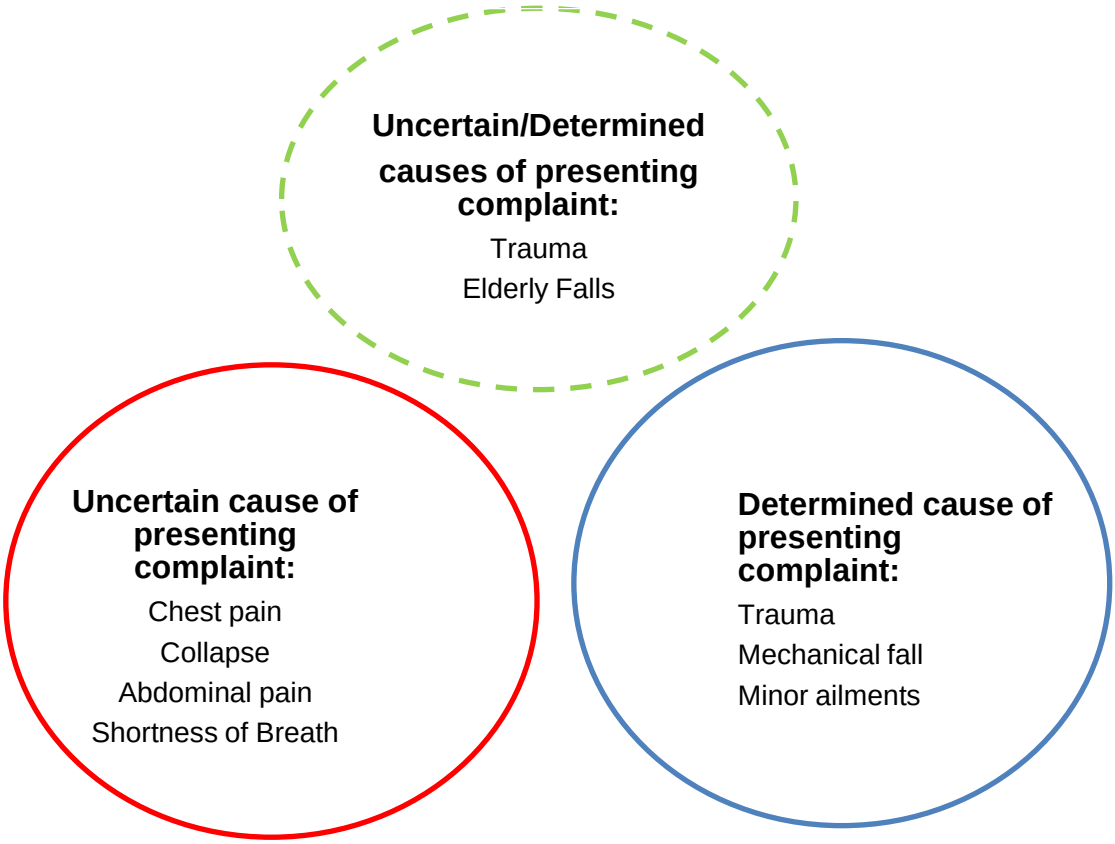


Diagram 6.3. Diagnostic paradigms

In Chapter 5.2.1, I used case studies to show examples of these three different diagnostic paradigms. In Chapter 5.2.1.1, six individual cases were shown where the cause of the patient's presenting complaint was uncertain. In these cases the clinical reasoning used by physicians was shown to be deductive and probabilistic. In Chapter 5.2.1.2 four individual cases were shown where the cause of the patient's presenting complaint was determined by the injury/ailment. In these cases the clinical reasoning used was shown to be causal. Lastly, in Chapter 5.2.1.3 four individual cases were shown where the cause of the patient's presenting complaint appeared to be interconnected between uncertain and determined causes. In these cases the clinical

reasoning was shown to be a mixture of deductive, causal and probabilistic reasoning.

6.4.4 Clinical reasoning

As previously mentioned, in the case of uncertainty, the physician's clinical reasoning usually involved using the patient's history to understand the patient's signs and symptoms. The physicians then reasoned whether they could recognise a pattern in the signs and symptoms which matched the common signs and symptoms of a certain disease /illness. The physician then usually undertook a full physical examination of the patient (Chapter 4.6.4.3). This included looking for any abnormality in the basic observations that had been previously recorded by the nursing staff (Chapter 4.6.4.2). Using probabilistic reasoning they weighed up the evidence from the information gathered and this led to the initial thoughts regarding forming a differential diagnosis.

In some cases, the outcome of this examination led to ruling in or ruling out a diagnosis, for example, the abnormal examination of a patient's chest and a high temperature pointing to the patient having a probable chest infection. Investigations such as chest x-rays and ECGs (Chapter 4.6.4.5 and 4.6.4.6) were usually ordered depending on clinical evidence. Blood tests were the highest recorded investigation recorded in the patients' medical notes (Chapter 4.6.4.4).

The probabilistic reasoning used by the physicians appeared to be based on an informal Bayesian approach (Chapter 2.6.1.8). The approach taken by ED

physicians followed the Bayes' formula to a certain extent, but did not formally find out the underlying frequency of a particular disease in the population. Instead they used their knowledge of the local community and the frequency in which certain conditions appeared in the ED. At the time of my fieldwork, the swine flu pandemic was present. The physicians had access to all the information available regarding its signs, symptoms and management. I was informed that this notification was the same for any new diseases. Interestingly, when interviewed, 50% of the physicians had no knowledge of Bayes' theorem and the other 50% expressed limited knowledge of the theorem (Chapter 5.5).

When I asked the lead consultant if physicians undertake formal training, he replied:

> I don't think medical students get trained routinely in Bayesian analysis (although it depends on which medical school - some do, some don't, according to a quick straw poll of my colleagues), but if you enter higher specialist training in emergency medicine as a doctor, you get trained in critical appraisal, and part of that will cover it.

Empirical knowledge also influenced probabilistic reasoning in the cases where the cause of the presenting complaint was uncertain. This is best shown by a response given by one of my physicians when asked if any factors influenced his differential diagnosis:

> I am in the South West of England and I am not going to see many patients with infectious diseases, the hazard is that it has happened

> twice...a Nigerian lad comes in renal colic pain so my differentials were schisomitis (parasitic disease), so a urine test is sent off which was negative, which it often is so I sent off serology... so you can make a mistakes in terms of sub specialising before you come into medicine. A girl came in and had come back from Ghana, she had a fever that came on and off with a sort of 9 hour cycle and it sounded very malaria like and she also had diarrhoea and abdominal pain which is a leading diagnosis, immediately my differential diagnosis would be malaria, whereas someone else would go she has a cough and fever it could be swine flu (Interview P.17).

In the cases where the cause of the patient's presenting complaint was determined by the injury/ailment the clinical reasoning was shorter. I found that physicians tended to focus on a short history related to the direct cause of the injury/ailment, for example; how it happened. The physical examination was usually local to the limb/area of the injury/ailment affected. Basic observations were not routinely recorded and investigations were based on clinical evidence. This is evidenced by the analysed data shown in Chapter 4.6.4. The main investigations used in these cases was a x-ray to rule in or rule out a fracture. This investigation was recorded in 60% of the medical case notes for patients with the presenting complaint of trauma.

In the cases where the cause of the patient's presenting complaint was seen to be a combination of uncertainty/determined, I found that a combination of

clinical reasoning approaches were used in these cases. The patients in this category were mainly elderly patients who had fallen. Any injury sustained in the fall was determined by the injury itself. The uncertain factor was the fall itself. The physicians were keen to establish if there was any underlying medical reason for the cause of the fall. Using probabilistic reasoning the physicians gathered information through the patient's previous history and drug history to see if there was a probable cause for the fall. For example; a change in the patient's usual medication. The physicians probed the patients to find out why they fallen, such as; were they giddy or faint prior to the fall (Chapter 5.2.1.3). Other cases in this category were patients who were admitted with an injury and were found to have an underlying disease/illness (Chapter 5.2.1.3).

6.5 The use of clinical evidence in clinical reasoning and causal attribution.

As previously mentioned, the physicians felt that the use of basic observations, physical examinations and investigations were important and relevant to the medical diagnostic process (Chapter 4.4). Nonetheless, it has been established that the amount of this clinical information recorded in the individual patient's medical notes varied (4.6.4). This variation was seen to be according to the uncertainty as to the cause of the patient's presenting complaint. When exploring the clinical evidence recorded within the patients' medical notes, I found that only 25% of the observations, physical examination and investigations were outside normal parameters[51]. I propose that it was these abnormal observations, physical examination and investigations recorded in

[51] This study has acknowledged that some investigations had been recorded in the medical notes as being requested and were yet to be carried out.

the medical notes which provided a useful insight into the probable causal conditions that may have influenced the physicians' clinical decision, as to the cause of the patient's presenting complaint. These abnormal findings showed anomalies that required an explanation. This explanation was sought through the comparative analysis of three groups. These were the groups where the physician has formed his/her impression/working diagnosis of either a chest infection, cardiac chest pain and fracture/suspected fracture. (Chapter 5. Chart 5.12).

6.5.1 Clinical evidence

In the cases where the impression/working diagnosis was fracture or suspected fracture I found that the recorded clinical evidence recorded in their medical notes showed that four of the patients had been examined by the physicians and were found to have an abnormal chest examination. The physicians had recorded hearing crepitations in their lungs. Seven of the patients were recorded as being hypertensive. However, these causal conditions did not appear to considered relevant enough to be recorded as part of the impression diagnosis/working diagnosis formed, which was recorded as fracture or suspected fracture in the medical notes.

In the cases where the impression/working diagnosis formed was cardiac chest pain, the clinical evidence was scant. The evidence of abnormal cardiovascular observations such as; blood pressure, pulse rate and ECG recorded in the medical notes were low. Therefore, it is assumed that the patient's history played an important part in causing the physicians to form of this impression/working diagnosis(Chapter 5.2.1.1). Another factor that may have

caused the physician to form the impression/working diagnosis of cardiac pain was risk management. The physicians had to make clinical decisions that did not leave the patient at risk or themselves liable to accusations of malpractice. Therefore, I think that an observation made by Macartney (1987:1327) is still relevant today:

> From a practical point of view, to diagnose the problem we do not have to be certain that the diagnosis is correct. All we need to know is that if we manage the patient on the assumption that this diagnosis is correct the patient will do better than if any other diagnosis is assumed.

A conclusive blood test called Troponin was recorded/requested in a number of cases. The time frame for the positive/negative result of this blood test to be relevant was > 6hrs from onset of chest pain. This was important to rule in or rule out if the patient had had a heart attack so the majority of patients were admitted to await the blood test result. Therefore the causal conditions for physicians forming their impression/working diagnosis of cardiac chest pain remains unclear.

In the cases where the impression/working diagnosis formed was chest infection, there was more clinical evidence recorded. The seventeen patients who were diagnosed as having a chest infection had presented with different presenting complaints. The patients had presented with either chest pain, shortness of breath or abdominal pain. The majority of patients had a previous relevant medical history including a relevant respiratory history recorded, Table 5.1. Most of the patients were on regular medication, however the significance of this on the diagnosis cannot be established owing to the fact that the drugs

may have been being given for other ailments[52]. A few of the patients were recorded as being hypertensive.

Although the clinical evidence recorded in the medical notes regarding abnormal observations and physical examination was more apparent, there were anomalies between the cases. In some of the cases there were only one or two of the causal conditions you could associate with a chest infection. For example, 50% of the patients were recorded to have exhibited the signs and symptoms of a fever. These patients were recorded as having a high temperature. In 86% of the cases, there was evidence of an abnormal chest examination recorded in their medical notes (Chapter 5.4). Therefore I suggest that a high temperature and abnormal chest examination could have been deemed as a sufficient condition for the physician to make the diagnosis of a chest infection. However, it could not be deemed as a necessary condition as it did not occur in every case, where the diagnosis of chest infection was made. It is worth noting that the two patients who did not have an abnormal chest examination recorded in their medical notes were both recorded as being pyrexial (had a high temperature). A chest x-ray was recorded or requested in the medical notes 98% of cases. This was used to rule in or rule out the diagnosis.(Chapter 4.6.4.6).

It is therefore possible to see clinical evidence of signs and symptoms recorded in the medical notes that supported the physician's impression/working diagnosis of a chest infection as the probable cause of the patient's presenting complaint.

[52] The study only recorded whether prescribed medicine was recorded in the medical notes. It did not detail the types of medication or their use.

6.6 Causal attribution.

As explained in Section 5 of this chapter, anomalies in the recorded clinical evidence occurred within the different diagnostic groups. Some of this clinical evidence was associated with the common signs and symptoms for the diagnosis made. These findings showed the percentage of patients who had causal conditions recorded in their medical notes. However, it presented little evidence about how these causal conditions presented in the individual patient. For example, did the patient with a high temperature also have an abnormal chest examination recorded in his/her medical notes? Therefore, the question I explored was ‘can I show the causal conditions *necessary* for a physician to form a medical diagnosis’?

My answer to this question was no. This has been demonstrated by using case-based probabilistic analysis; examining each individual case in each diagnostic group. As shown in Chapter 5.4, not all patients with the same diagnosis have the same causal

conditions. This is clearly shown in Tables 5.1. 5.2 and 5.3 in Chapter 5.4. However, in two of the impression/working diagnosis categories, I propose that I have shown sufficient causal conditions, which did influence the physician’s clinical reasoning.

These two impression/working diagnosis categories are chest infection and arrhythmias.

6.6.1 Impression/working diagnosis

My study has shown that although the causal conditions were present in the majority of cases where the physician had formed the impression/working diagnosis of a chest infection, they were not present in all the cases (Chapter 5.4.Table 5.2). Therefore the causal conditions present can only be seen as sufficient to make that diagnosis, but not necessary. This is shown in the diagram below:

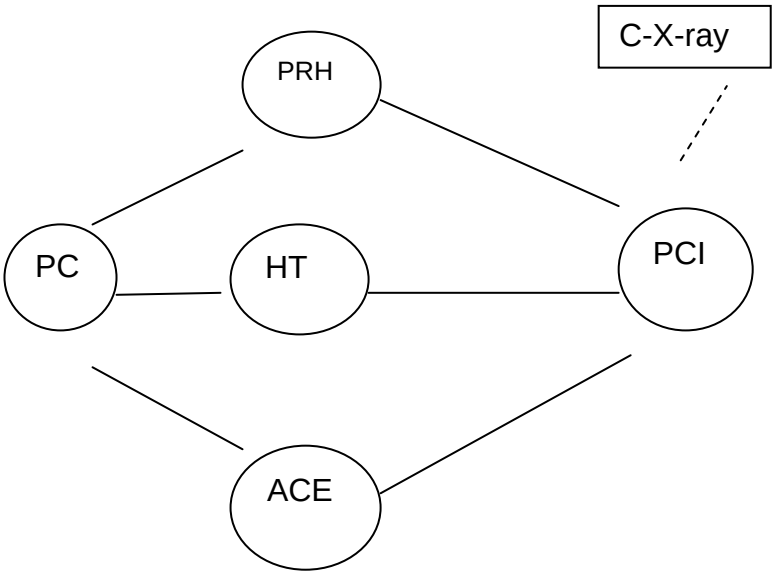


Diagram 6.4 – Probable causal attribution – chest infection

Abbreviations:

PC - Presenting Complaint (chest pain, short of breath and abdominal pain).

PRH- Previous Relevant History

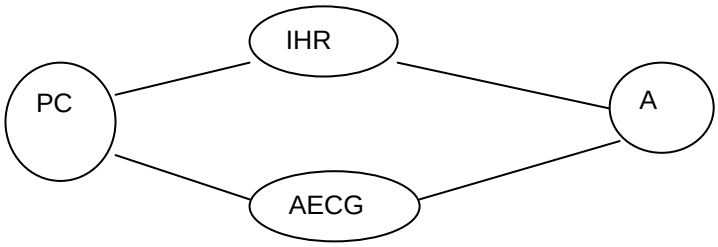
HT – High Temperature

ACE- Abnormal Chest Examination

Chest X-ray- pre or post diagnosis (to confirm or falsify clinical findings)

PCI – Probable Chest Infection

The clinical evidence which caused the physicians to form their impression/working diagnosis of arrhythmias was clear. Arrhythmias is a term given to an irregularity with the rate and volume of the heart beat. All the cases showed that an abnormal pulse and an abnormal ECG were recorded in the medical notes. These were necessary causal conditions when the diagnosis of arrhythmias was made. However, only eighty-six percent (11/13) of the patients presented with collapse. Therefore this causal condition can only be seen as sufficient to make that diagnosis, but not necessary. A probable causal attribution for arrhythmias is shown in the diagram below:



6.5 – Probable causal attribution - arrhythmias

PC – Presenting Complaint – collapse/shortness of breath/chest pain

IHR- Irregular Heart Beat

AECG- Abnormal ECG

A- Arrhythmias

Unfortunately, owing to the lack of recorded abnormal clinical evidence in the medical notes of some of the patients, it was difficult to show reason for the physicians' causal attribution. The causal conditions recorded showed no particular pattern in the impression/working diagnosis categories; cardiac chest

pain, other infections, fractures/suspected fractures and gallstones/gastric problems.

The clinical evidence which caused the physicians to form their impression/working diagnosis of cardiac chest pain was scant (Chapter 5.4, Table 5.1). However, evidence of a previous cardiac history was found in 71% (27/38) of the medical case notes for patients in this category. Therefore this causal condition may have influenced physicians' clinical reasoning.

The clinical evidence which caused the physicians to form their impression/working diagnosis of fracture/suspected fractures was clear. In a majority of the cases it was based purely on the history of the injury and the clinical signs of the limb involved. The diagnosis was ruled in or ruled out by using an x-ray (Chapter 4,6.4.7 and Chapter 5.4 Table 5.3). An x-ray was found to have been recorded or requested in 79% (30/38) of the patients' medical notes.

The clinical evidence which caused the physicians to form their impression/working diagnosis of gallstones/gastric problems was unclear (Chapter 5.4.Table 5.4). In all cases, the presenting complaint was abdominal pain. Only 18% (2/11) had an abnormal abdominal examination recorded in their medical notes. An abnormal urinalysis was recorded in 45% (5/11) of the patients' medical notes, although a urinary infection was not given as their diagnosis. 27% (3/11) of the patients had an abnormal blood pressure recorded. However, 55% (6/11) had a previous relevant history recorded in their medical notes.

The clinical evidence which caused the physicians to form their impression/working diagnosis of 'other infection' varied. A number of patients where this diagnosis was given had an abnormal temperature, although not all. A majority of patients had an abnormal urinalysis result recorded in their medical notes. Others had clinical signs recorded, such as; 'offensive smell of urine'. In some cases the infection was clinically evident; as it was localised to a limb or area (e.g. limb or area would look red and inflamed).

The clinical evidence which caused the physicians to form their impression/working diagnosis miscarriage gynaecological problems was based on the patients' histories, clinical examination and their age (Chapter 5.2.1.1. Case 5).

6.7 Diagnostic Errors

The lack of recorded clinical evidence does present some concern. It is difficult to explain the quality of the information that the physicians are using to inform their clinical reasoning. In the ED, the impression/working diagnosis was based on probability. It is acknowledged that a majority of patients were admitted to another ward within the hospital to await results of blood tests, further investigations or treatment. It is also acknowledged that the ED physicians themselves felt that their diagnosis was subject to error and therefore I suggest that what they were undertaking was risk management using probability. I found that this finding was not isolated to the ED I was studying. This is shown by a study undertaken by Bhandari (2009:307-12) auditing junior doctors diagnostic

activity in medical admissions showed that in the A&E (ED) setting, 53%(53) of the patients were given a ‘symptom’ as their diagnosis or differential diagnosis. ‘In 18% of cases the A&E assessment implied a different domain from the eventual diagnosis; for example, a diagnosis of ‘chest infection’ when the eventual diagnosis was pulmonary oedema due to ischaemic heart disease’. The junior A&E diagnosis agreed with the eventual consultant diagnosis in 22% of cases. Whereas in the MAU (medical assessment unit) 20% of the patients were given a symptom as their diagnosis; with 11% in the wrong domain. 45% were in agreement with senior opinion.

The overall trend for a correct diagnosis correlated with seniority (Figure 3; r=0.9, p=0.039). However, the overall percentage attempting to document diagnoses remained surprisingly low. Comparing A&E to AMU junior doctors indicated that leaving a symptom documented as the final ‘diagnostic’ conclusion was more common in the A&E setting (median 50 vs 20.6%; p=0.047). There was no statistical difference in documenting a correct diagnosis but a clear trend to this being better in the AMU setting (median 17.7 vs 44.4%; p=0.072). This study acknowledged its limitations, as a majority of the 100 patients came in with presenting cardiac or neurology complaints. The physicians involved came from different countries and had received medical education in those countries. These factors were not part of the study.

6.8 Concluding comments

The study on which this thesis reports focused on the social process and clinical reasoning that underlies causal attribution when physicians form a medical diagnosis.

My data shows that the medical diagnosis process is complicated. I found that it comprised of a diagnostic step process and clinical reasoning accumulating in a clinical decision. This was the formation of an impression/working diagnosis as to the cause of a patient's presenting complaint. Following taught sequential steps, the physicians gathered information from the patients. This was found to be achieved through the physician/patient interaction which played an important part in the medical diagnostic process. It was acknowledged by the physicians, that it is important to treat the patients with respect in order to build a rapport. Physicians felt that this rapport with the patients, helped them to gain the patients' history/narrative. One of the key factors found in the diagnostic process was the questioning of the patients. It was established that this questioning was based on the physicians' biomedical, pathophysiological and empirical knowledge. The questions focused on the signs and symptoms that were exhibited by the patients. This information was used by the physicians to recognise any patterns of signs and symptoms. These patterns related to known illnesses/diseases or some condition the physicians had seen before. A differential diagnosis (hypothesis) was formed and then, using combined clinical reasoning approaches, the physicians deduced the probability of their hypothesis being correct or false.

The depth of information gathered and then recorded in the patients' medical notes varied. In a majority of cases, this was shown to be related to the physicians' uncertainty as to the cause of the patient's presenting complaint. Closer exploration using case-based probability of the individual patient's recorded medical notes showed that in many cases, there was limited recorded clinical evidence as to the causal conditions that led to the physicians forming their impression/working diagnosis.

However, there were two diagnostic categories, that did provide clinical evidence of causal conditions that were sufficient to influence the physicians' causal attribution prior to forming their clinical decision, as to the cause of the patient's presenting complaint. These two diagnostic categories were chest infection and arrhythmias. The causal conditions were recorded in the medical notes of the individual patients in each category. Therefore, sufficient causal conditions were proposed for each category.

The anomaly within the study, was the diagnostic category of fracture/suspected fracture. As previously established, the diagnosis was determined by the injury and a x-ray was used to verify or falsify this diagnosis. In these cases, the majority of patients were found to have an x-ray recorded or requested in their medical notes.

In the other diagnostic groups, such as, cardiac chest pain, other infections and gallstones/gastric problems the clinical evidence of causal conditions was found to be poor. This meant that in was difficult to propose an explanation as to how the physician had formed his/her diagnosis. Therefore, the assumption made

was that in some cases, it was the patient's narrative or previous medical history led to the diagnosis that was formed. Although difficult to evidence, this may have been influenced by the physician empirical/tacit knowledge. I recognise that this assumption is questionable, due to the fact that the study took place in an ED. It has been important to acknowledge that in the ED, the physicians risk manage their patients. This is shown by a high admission rate of 59% (120/202). This meant that the patients were transferred to either the (CDU) Clinical Decision Unit or into other wards within the hospital, to await the results of tests taken or to undergo more investigations.

Chapter 7 – Reflections

7.1 Introduction

In this final chapter, I reflect on the process and product of my research. This includes an evaluation of what went well and what could have been improved. I also consider why and how the findings of my research may have implications for future clinical practice and for future research.

7.2 Reflections on the process

7.2.1 Methodology and methods.

When designing the research study, I chose the methodology and methods carefully, to allow me to collect a range of data to enable me to understand how physicians diagnose the cause of disease/illness. I feel that my mixed method approach worked well overall and that I met my research aim and objectives. In Chapter 3.7 I gave an account of my personal dilemmas when undertaking the fieldwork. Here, I provide an overview of the methods used and what I considered to be the positive and negative aspects of each method and their subsequent outcome (Table7.1).

Method	Positive	Negative	Outcome
Physician Interviews	Structured questions work well.	Should have asked more questions about clinical reasoning approaches.	Provided clear evidence of a taught medical diagnostic step process.
Non-participant observation	Taped narratives.	Ethical constraints.	Captured the essence of the physician/patient interaction.
Medical notes	Reflected the physician /patient interaction clearly.	My transcribing time consuming in the clinical setting.	Provided recorded clinical data/evidence.

Table 7.1- reflections on methodology and methods.

7.2.2 Data analysis/interpretation

I found the analysis of the data quite challenging but strangely enjoyable. I was pleased with the amount and diversity of data I had managed to gather. The analysis of the physicians' interview data went well. By using Nvivo 8 I was able to establish useful common themes. When presenting the data I found that the use of the interview taped narratives really helped to support and enhance my findings and provided an insight into physicians' views on topics relating to the medical diagnosis.

The use of Nvivo 8 did not go so well when trying to analyse the taped overt observation narratives. This conversational data did not suit the use of NVivo 8 as it was extremely difficult to ascertain any common emerging themes. Nonetheless, it did provide some information which informed the subsequent

grouping of patients, as groups of patients' presenting complaints did come into view. The lack of analysis of this data was not detrimental to the research as I feel that presenting the taped narratives in their entirety did provide 'a picture' of the physician/ patient interaction that took place.

The analysis of subsequent medical notes provided recorded clinical evidence of the process that took place. The creation of my variables went well, as I felt I had captured every real character of the information recorded by physicians in the medical notes from its original form. This was extremely important to me, as although my clinical experience was useful when interpreting the data, I was also aware that my 'insider' position could be detrimental to the research in terms of prior assumptions. Therefore, I was careful not to make assumptions about the data and ensured that the process I used for interpreting it remained transparent (Chapter 3.9).

Using the original data recorded by the physicians in the medical notes meant that I used the characters from real cases to create my variables. This meant that my variables were categorical (Chapter 3.8.4) to reflect the different causal conditions in each variable. The downside of this, was that I found that when I tried experimenting with different analysis techniques, such as cluster analysis and multivariate analysis, my categorical variables were not suitable because these tests also required the use of one or more continuous variables. Nonetheless, on reflection, I feel that the way in which I used these categorical variables added a richness to the research because I avoided reducing the data too early. I became familiar with the content of my data and by using my clinical knowledge of medical terms could explore the descriptive and frequencies analysis to inform my grouping of patients. This said, I did change my

categorical variables into binary variables in the later stages of my analysis so that I could carry out QCA. I found QCA a useful tool to see causal and outcome conditions in the main group. However, I found that my results were inconclusive when using QCA on smaller categories (Chapter 3.8.4).

An overview of the analysis/interpretation used and what I considered to be the positive and negative aspect of each method is shown in Table7.2.

Data	**Analysis**	**Positive**	**Negative**
Taped physician interviews	Nvivo 8	Proved useful for identifying common themes.	Did not represent the content of the narrative.
Taped overt observation	Nvivo 8	Helped with initial thoughts regarding grouping.	Limited use on this type of data. Difficult to see any trends emerging. Did not represent the content of the narrative.
Transcribed medical notes	SPSS	Useful for creating variables, running frequencies, descriptive analysis and identifying groups.	Using characters from real cases meant that my variables were categorical. The descriptive analysis only showed the association of variables.
	QCA	An aid to my interpretive analysis. Could see causal and outcome conditions in main group.	Had to change categorical variables into binary variables. Inconclusive results when using smaller groups/categories.

Table 7.2 – Reflecting on my data analysis

7.3. Reflections on and Implications of the Product.

Several of my research findings have implications for future clinical practice and future research.

7.3.1 Pattern recognition/patients' narrative

As previously discussed in Chapter 2.6.1.10, pattern recognition was defined as an approach to clinical reasoning, with physicians associating clinical signs and symptoms displayed by the current patient with previously seen patients, through the retrieval of knowledge (Coderre et al 2009) and resemblance to memory of a past case (Brooks et al 1991). The study has shown that the physicians' questioning of the patients was governed by the patients' presenting complaint (Chapter 4.4.1 and 4.4.2). The questioning focused on pattern recognition, with the physician asking questions linked to known common signs and symptoms of diseases. This finding although not unique adds an interesting aspect that has not been highlighted in previous research, that is the impact that this form of questioning has on the patient's narrative.

Previous research has placed an importance on the patient's narrative (Bleakley et al 2011; Kalitzkus and Mattheison 2009) and the skills required by physicians when taking a patient's history (Bates 1995). I found that although the physicians were very respectful of the patients, making sure to put them at their ease, they controlled the patient's narrative. The type of questioning used by physicians implied that they formed their opinion on the cause of the patient's presenting complaint very quickly. They asked questions of the patient to see if their signs and symptoms could fit a certain disease. There was limited room for the patient's narrative other than them answering an open question such as *'what has been happening to you?'* (see Chapter 5.2.1). The patient's response to this open question was curtailed very quickly by the physician, as they moved swiftly on to asking the patient a series of questions about their symptoms and previous relevant history. In some cases, social questions were asked but

these were closed questions, such as; do you smoke, are you married etc. When discussing some of my initial findings with the lead consultant he quoted 'listen to your patient, he (sic) is telling you the diagnosis' - William Osler (1849-1919). Yet, my findings suggest that the physician/patient interaction is imbalanced, with the physicians' biomedicine and pathophysiology knowledge controlling the discourse. By asking questions to fit their initial thought as to what caused the patient's presenting complaint, they are curtailing the patient's narrative which may or could prove to be more useful to their diagnostic skills.

Following this, the implications for clinical practice are:

1. To raise the profile of the importance of the patient's narrative in the medical diagnostic process within medical education. This could be achieved through data from my study being used as part of a core component of a teaching model at Plymouth Medical School and could also be developed for other medical schools.

The implication for future research are:

2. To undertake a comparative study of the physician's questioning and the patient's perception of how physicians listened to them and if they felt that the questioning could be improved upon to allow them more input into the medical diagnostic process.

3. To understand the way in which physicians focus their questioning on the signs and symptoms of a certain disease and to see if this taught process has implications for misdiagnosis.

7.3.2 Clinical reasoning

Uncovering ***how*** physicians diagnosed the cause of the patient's presenting complaint proved difficult. As previously mentioned in Chapter 5.2, my findings show that the clinical reasoning approaches used by physicians varied depending on the patients' presenting complaints. This finding was similar to previous views expressed regarding clinical reasoning (e.g. Norman 2005, Elstein et al 1978, Burstajn 1990). However, I found that the approach used depended on the uncertainty of the cause of the patient's presenting complaint. I also found that a combination of clinical reasoning approaches could be used. On reflection, I wish that I had asked more questions of the physicians at interview regarding their perception of the different types of clinical reasoning they used. If I were to start again, I would ask more direct questions regarding the clinical reasoning approaches used, in particular; hypothetic deductive reasoning and probabilistic reasoning. Hindsight is a wonderful thing!.

Following this, one implication for future research is:

1. Establishing physicians' perceptions of the clinical reasoning approaches used when trying to establish the cause of the patient's presenting complaint.

7.3.3 Blending clinical reasoning with evidence-based medicine

I managed to establish how physicians *blended* their clinical reasoning with evidence-based medicine. The interview question focusing on this was well received by physicians. I found their high regard for evidence-based medicine reassuring, even though the senior physicians were a little more sceptical. What I did find interesting, was how the use of protocols and guidelines were seen as

a natural part of the ED environment. Whilst accepting the view of Than et al (2005) that physicians felt that systematic reviews and guidelines did not relate to individual patients, I found that the local protocols and guidelines were tailored to inform the care of the individual patient. The physicians acknowledged the individuality of the patient and the role this has to play when using evidence-based medicine. It was evident from my research that physicians use of protocols and guidelines appeared seamless with their clinical practice. This finding supports the point made by Sackett et al (1996:71) suggesting that 'good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough'. Admittedly, the junior physicians accessed protocols and guidelines more frequently than the senior physicians. However, I found that the senior physicians played a huge part in the writing of some of the local protocols. One message that came across quite forcibly was the need for evidence-based medicine to be up-to-date and for physicians to be allowed to use it flexibly within the realms of their own experience.

Following this, one implication for clinical practice is:

1. Greater involvement of practising clinicians in the writing and updating of protocols and guidelines.

7.3.3.1 Clinical reasoning in the emergency department context.

As previously mentioned in 1.2, the emergency department is a busy clinical environment where clinical decisions have to be made within tight time-scales. Although the clinical environment provides grades of physicians who have diverse levels of experience, they are generalist with the main aim of ruling in or out life threatening conditions. The use of protocols, guidelines and experiential

learning through the interaction of junior physicians with the senior physicians regarding each patient case supports the nature of the ED environment. This is discussed further in 7.3.4.

7.3.4 Causal attribution

One of the most difficult aspects of my study was trying to provide an explanation of the physicians' clinical reasoning process and causal attribution which led them to forming a medical diagnosis. My findings have thrown up a raft of questions that need to be considered. In Chapter 6, I discussed how some impressions/working diagnoses could be given a probable causal attribution explanation and others not so easily. The main point I made was that there was limited clinical evidence recorded in the medical notes to suggest how the physician had reached their impression/working diagnosis.

I have reflected on this finding and thought about other causal conditions that may have played a part; in particular patients' histories. However, I had already established that a relevant history was recorded in about half of patients' medical notes, and this was only where the cause of their presenting complaint was uncertain. In the case of family histories, this was only seen to be relevant in nine cases whose presenting complaint was chest pain. Therefore, the only history which seems to have been a causal condition was where the patients had a significant cardiac history recorded in their medical notes; cardiac chest pain (22/48); collapse (9/32%) and mechanical fall (4/26%). So, in the cases where it has been difficult to pinpoint any causal conditions that may have influenced the physicians' decision as to the cause of the patients' presenting complaints, I have found myself still asking the question, in these cases 'how did the physicians make their diagnosis?' in light of little clinical evidence or

significant medical histories recorded in the medical notes. To fathom this out, I have considered the following:

1. Did the medical setting of an emergency department influence the medical diagnostic skills of physicians in determining the cause of the patients' presenting complaints?
2. Were the medical notes recorded by physicians sufficient to reflect necessary clinical evidence to support the physicians' clinical decision?

I found that the diagnostic step process undertaken by physicians in the ED followed a taught sequence of steps for use in **any** medical setting. I have established that combined clinical reasoning approaches were used by physicians, especially when the cause of the patient's presenting complaint was uncertain. Therefore, my reflection focuses on the ED medical setting and whether this influenced the physicians' impression/working diagnosis. An impression/working diagnosis as to the cause of the patients' presenting complaints was made for all 202 patients involved in the study. ED physicians admitted 120 (59%) of these patients. Some patients were transferred to the CDU (Clinical Decisions Unit) or to other wards to await blood results, further tests, investigations or treatment. The questions I asked myself were, did the fact that the physicians were able to admit patients to await results etc, limit the way in which they formed their diagnosis? Were they just playing it safe? Was the diagnosis made just used as a risk management tool?

Wilson and Tingle 1999: 16) suggest that 'risk management is an important part of healthcare delivery and is seen as the systematic identification, assessment and reduction of risks to patients and staff'. For the patients this would mean

that physicians assume the worst scenario and admit them. For physicians this would mean erring on the side of caution to avoid any litigation.

I decided to revisit my data and see if this was the case. I found that the biggest group of patients admitted were the patients with a diagnosis of cardiac chest pain 97% (37/38) of these patients were admitted for tests. The majority of these patients were awaiting the result of the conclusive blood test which ruled in or ruled out a heart attack. Patients with the diagnosis of chest infection 76% (13/17) were admitted for further treatment and patients with the diagnosis of fractures/suspected fracture 66% (25/38) were admitted for treatment to stabilise their fracture. Patients with arrhythmias 85% (11/13) were admitted for treatment and patients with a neurological condition 75% (12/16) were admitted for further investigations. In the case of patient with a diagnosis of gastric problems 64% (7/11) were admitted.

I recently discussed this finding with the lead consultant in the ED and he pointed out that physicians in the ED are ruling out life threatening conditions. For example, when someone is admitted with chest pain, physicians rule out a heart attack, aortic dissection or pneumothorax. In the case of a person with abdominal pain, physicians rule out – perforated ulcer, peritonitis, and whether the patient needs an operation. Once these conditions are ruled out the patient can go home for GP follow up. The GP may refer the patient to another specialist for further tests or investigations, therefore the diagnosis may be made much later. He also pointed out that sometimes four hours is not long enough to make a diagnosis, so they are assessing for serious illness. The lead consultant also pointed out that ED is only part of the patient's exposure to healthcare.

From a research perspective this was interesting. I felt reassured that the medical diagnostic process itself was not affected by the clinical setting but that their causal attribution and management of the patient probably was. Physicians had to use their clinical reasoning to rule out a serious condition. Owing to the nature of the ED setting they had to make safe clinical decisions regarding the management of patients. Therefore, I am assuming that their causal attribution aired on the side of caution. However, I still feel that the impression/working diagnosis formed by physicians should have been clinically evident.

The recorded medical notes are supposed to reflect how the physicians decided on their impression/working diagnosis. They are a legal document and as such, should they not provide some indication of the clinical reasoning that took place in light of scant clinical evidence being recorded? It would be useful if there could be an inclusion in the medical notes where physicians can state why they felt that the patient's narrative or the patient's previous history informed their clinical decision. This would be beneficial when there is limited clinical evidence and could be a useful training tool.

Following this, one implication for future clinical practice is:

1. To provide a space in the ED medical notes for free text, so that physicians can provide some indication of their clinical reasoning leading to the forming of a medical diagnosis, especially when clinical evidence is scant.

7.4 Ethical Constraints

Although, I was able to explore the clinical assessment of patients, I acknowledge that ethical constraints placed on my study had a huge impact. I found that not only did it narrow the diversity of the study, but also had an impact on my fieldwork (Chapter 3.7.5) The inclusion/exclusion criteria set by the ethics committee was very strict. I feel that this was due to how closely social ethics are aligned to medical research ethics (Beauchamp and Childress 2001) in NHS research. I consider this to be limiting in social research, as clinical drug trials are very different . The exclusion/inclusion criteria excluded paediatrics[53] and patients who were confused, unconscious or under the influence of alcohol or drugs. I also had to exclude patients with a recognised mental health problem.

Personally, I feel that my study has done a disservice to these vulnerable groups by having to exclude them. I feel guilty for agreeing to the exclusion/inclusion criteria quite freely, as it meant that I would receive the ethical approval necessary to enable me to start my fieldwork. I was so keen to get started, that at this stage I did not realise the full implications of that agreement on the outcome of my research. On reflection, I now believe that as researchers we need to be more accountable for the quality of our research and more forceful to ensure that we include vulnerable groups, so that they are not segregated from social research studies.

> Research with vulnerable populations challenges us to consider once again ethical principles basic to research. Issues of providing informed consent, maintaining confidentiality and privacy, weighing the risks and benefits of a study and paying attention to issues of

[53] I had excluded paediatrics myself, as I was aware of the legal implications, when working with children and also aware that within the ED, children were looked after in a segregated area would be difficult logistically to manage.

> fairness are all especially important when working with groups who are vulnerable (Flaskerud and Winslow1998: 69)

The exclusion of various groups of people from my study, assumes that they do not have the rights of other members of society, although they form a major part. This seems ridiculous, especially in the case of people with recognised mental health problems. One in four of us will experience a mental health problem at some point in our lives (www.mind.org.uk). With such a high prevalence of mental illness in society, the treatment, care and support of the mentally ill should be of paramount importance/interest. Many people with recognised mental health problems are still in gainful employment, have families, homes and lead fulfilling social lives:

> Vulnerability' and 'marginalisation' can mean different things to each of us, but the range of individuals and groups who are sometimes described as 'vulnerable' or 'marginalised' by service providers is very large. It may be that some of these people would not describe themselves as vulnerable or marginalised at all. Whether or not you are perceived or perceive yourself as vulnerable or marginalised will probably depend on where you are standing at the time, and in relation to who, or what (Steel 2003: 1).

It is suggested that the tackling of social exclusion and the reintegration of people with a mental illness into society depends on improving their social function (Tyrer et al, 2002). The question for researchers is how can we study the success of this reintegration if we have to exclude these people from our social research studies?

In my study, I would have liked to show the way in which physicians communicated with patients with a recognised mental health problem. In fact, in

some cases, I had gained a patient's written consent to participate in my study only to realise when the physician started asking them questions, that I had to exclude them. In these cases, I stopped recording the patient/physician interaction straightaway. I then waited until the end of the interaction and explained to the patient that I would not be using their case as it did not meet my criteria. I did not tell the patient that it was due to them having a recognised mental illness, as I felt this was unfair and would add to the labelling of them. The consent form was voided and I erased any notes I had made or recorded.

I wish now, that I had fought harder to include the other vulnerable groups, excluded from my study, such as; patients who were unconscious, intoxicated or under the influence of drugs. I should have made a case for the use of a proxy consent, so that where possible the patient's relative, carer or recognised other could have consented on their behalf. Studies where proxy consent has been previously used involved research with young children, with mental health service-users, with people with learning disabilities and with older, infirm people (see, Cameron et al 2004; Goodenough et al, 2004) cited by (Wiles et al 2005).

Ethical guidelines for educational research, advise that the spirit of Articles 3 and 4 of the United Nation Convention on rights of a child, should also apply in research contexts involving young people and vulnerable adults. These articles state:

> Article 3: The best interest of the child must be a top priority in all actions concerning children.
>
> Article 4: Every child has the right to say what they think in all matters affecting them and to have their views taken seriously.

A proviso is added to these articles:

> In the case of participants whose age, intellectual capability or other vulnerable circumstance may limit the extent to which they can be expected to understand or agree voluntarily to undertake their role, researchers must fully explore alternative ways in which they can be enabled to make authentic responses. In such circumstances, researchers must also seek the collaboration and approval of those who act in guardianship (e.g. parents) or as 'responsible others' (The British Educational Research Association, 2011: 6).

Whilst accepting the ethos of this advice, it is necessary for ethics committees to look at individual research proposals and to understand the nature of the research. For example, my research was concerned with how physicians diagnose illness. This is a social process undertaken every day, either in GP practices, hospital wards or emergency departments, involving patients of all ages, some of whom are defined as vulnerable. My emphasis was not on the patient, but on the physician. Therefore by excluding these patients, I was unable to see if their vulnerability made any difference to how the cause of their illness was diagnosed.

It was extremely annoying and frustrating to have to exclude myself from clinical situations that had previously been in my domain. It meant that I was not allowed to observe how physicians formed their diagnosis as to the cause of the patient's presenting complaint with these vulnerable patients, and yet previously, I had been responsible for their care and wellbeing.

I wonder if I had made more of my clinical background as a registered nurse and a senior manager in the NHS would this have changed anything with the ethics committee! Should I have been more forceful in reassuring them that I would behave in an ethical/professional manner? On reflection, I think that this was due to the fact that this was not my first experience of how research involving vulnerable people was treated with caution and trepidation by an

ethic's committee. I had a number of issues raised when proposing to examine the use of Health of the Nation Outcome Scales (HoNos) in mental health recovery units, when undertaking my MSc in Social Research. I had to go before two ethics committees on two separate occasions, and in the end, owing to time constraints, could only undertake a service evaluation instead of a research study. What was ironic here, was that I used exactly the same protocol, but because it was not called research, this was alright. I think that this experience made me wary, as I did not want the same thing to happen again.

In light of these reflections, I feel that the outcome of the ethical constraints placed on this study, has significant implications for future research and I suggest that the ethical constraints regarding the exclusion of vulnerable groups should be revisited. Researchers may need to ensure that their proposals are written clearly especially when a research proposal includes individuals defined as vulnerable. Ethics committees should take into account the background and experience of the researcher. I think that it would be useful for the researcher to set out the effect of not only including them in their research, but also the consequences of excluding them from their research.

Following this, an evident implication for future research, practices and processes is:

1. A reconsideration within IRAS and more broadly – of the inclusion of vulnerable people in research studies. Including the consequences of excluding them.

2. In NHS research studies, a separation should be made between social research and medical research. This should be supported with the use of new documentation developed to enable a full explanation of the benefits

of including vulnerable groups in research and the consequences of excluding them.

7.5 Personal reflection

I came to this study, at a time when I had decided to make some life changing choices. I had decided to retire from a long career in the NHS. My daughters had all had children and I thought it would be nice to help out with childcare. At the same time, I had always wanted to undertake a PhD, so I applied for a research scholarship. I had proposed to undertake my own project, building on the outcome my MSc in Social Research. However, when I received an invitation to attend the university for an interview, it was for a research study looking at causal attribution in medical diagnosis in a medical setting. The first decision I was faced with was where to start. I needed to consider which clinical area would provide the best information, this I achieved by drawing on my previous clinical experience and knowledge of the NHS. Once this decision was made, I started to prepare my research protocol and my literature review. Fortunately, I was supported by really good supervisors. My first couple of meetings with them were interesting. I felt completely out of my comfort zone, I would listen to them talking in-depth about sociological and philosophical issues, and thought to myself, ‘I have nothing to contribute’. The only time I felt confident was when I could add my views on the clinical aspect of the study. I felt an academic fraud. Fortunately, I found that as time progressed and I had gained more academic knowledge on these subjects, my confidence grew and the dynamics of the group changed.

My choice of methodology and method was influenced by the information I wanted to gather. From my clinical perspective, I knew that I needed to capture

the physicians' own views on different aspects of how they formed a medical diagnosis, at the same time, understanding these views needed to be linked back to existing literature. I got a buzz from designing my questionnaire, from filling in gaps in my academic knowledge and from being a mature student. I enjoyed attending meetings and conferences and meeting people in the same position as myself. I found that my peer group were feeling the same as I was, this in itself was comforting. Gaining ethical approval for our studies was always a call for a celebration.

As discussed in 3.7, I did face some personal dilemmas in the field. Reflecting once again on this, I think the most unexpected aspect, was how uncomfortable I felt in the clinical setting. After all, I had spent forty years in this type of environment. I felt that my researcher role was like being in no-man's land. I did not feel that I fitted in, my sense of belonging was missing. From a management perspective, there were a few things I wanted to offer advice on, but in my researcher role was unable to do. I felt disempowered. The only time I felt really comfortable was when I was meeting and talking with patients and relatives, this made me recall how the instant feedback from this type of interaction was very gratifying and it reminded me of why I went into nursing in the first place. When observing the physician/patient interaction, I found myself once more drawing on my clinical past and remembered clinical information that I thought I had forgotten. I found it fun to silently guess the diagnosis before the physician did and in some circumstances had to bite my tongue not to say anything. One instance, I recall when an elderly man was admitted with abdominal pain and the physician was querying an abdominal aortic aneurysm. I felt like advising the physician to take the patient's blood pressure in both arms? (as I knew that with this condition, the blood pressure is usually different in each arm).

Fortunately, a more senior physician did offer this advice. (If the senior physician had not offered this advice, I would have mentioned it in private to the junior physician).

When I had finished my period of fieldwork, I felt relieved. Even though I had a great deal of data to analyse/interpret. I felt that I was no longer ‘performing’ and could retreat to my office and be myself. By this, I mean that I had found it unnatural being in a clinical area without my normal defined role, which usually gave me control and if I am honest, recognition and status. During the analysis/interpretation of my data, I was like a dog with a bone. I played around with my data for hours and hours. This required a great deal of concentration. I found that my clinical knowledge and the academic skills learnt during my MSc in Social Research were invaluable. To my relief, I had kept all my notes and course handouts. I did experiment with different analytical methods, some of these were not suitable for my data. I found this slightly disconcerting, as I thought at one stage that I should be using things like logistic regression, to show my academic ability! However, when I did undertake this, I found that it did not add any substance to my findings, and by this stage, I had the confidence to leave it out of my final writing up. Although the final writing up of the thesis was a challenge, I am pleased with what I have accomplished.

7.6 Final words

The research study on which this thesis is based has met its aim and objectives. I feel privileged to have been able to gather so much real data regarding the medical diagnostic process in a clinical environment. I see this as a strength of the product.

The research has clear implications for clinical practice and future research as highlighted above and contributes to methodological understanding and sensitivities of work in this area. Overall, undertaking this research and writing this thesis has been an interesting and challenging experience. Personally, it is a fascinating postscript to my years of clinical practice and management within the NHS.

Glossary of Physicians' Grades

Grade of Physician	Glossary of role
Junior Doctors	Undertake a five-year course of study to become a doctor - usually two years studying basic medical sciences followed by three years of more clinical training during which they work in hospital wards under the supervision of consultants.
	In training, usually in hospital or in general practice. They will have completed medical school and obtained registration with the GMC, but will not yet be trained to a level which allows them to work as a consultant, GP or staff and associate specialist. As they progress through training and gain experience, their responsibilities increase, but they are always under the supervision of a senior doctor, though not necessarily directly. (FY1 and FY2 are year 1 and year 2 foundation doctors. FY1 equates to the old grade pre-registered house officer and FY2 senior house officer)

Staff Grade/ST1/ST4	SAS doctors are an experienced group of hospital doctors who have spent some time as junior doctors but most of them have not completed the entire specialist training in the UK needed to be registered on the GMC's specialist register. Some SAS doctors do however achieve specialist registration by having their qualifications and experience assessed by the PMETB, and for personal reasons remain practicing as SAS doctors rather than taking up consultant posts.
Consultant	Allowed to practice independently and are considered to be fully trained, although all doctors are required to pursue continuing professional development (CPD) throughout their careers. Consultants are responsible for the education and supervision of junior doctors, and for the supervision of SAS doctors.
Associate Specialist	Has trained and gained experience in a medical or surgical specialty but has not gone on to become a consultant. These doctors usually work independently but will be attached to a clinical team led by a consultant in their specialty.

Definition of physicians' grades provided by the General Medical Council (April, 2009).Writing in brackets added by researcher.

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