Clinical information needs of doctors in the UK

by

Karen Davies

Doctoral Thesis

Submitted in partial fulfilment of the requirements

for the award of PhD of Loughborough University

April 2008

ABSTRACT

The aim of this study was to determine the information-seeking behaviour, needs and preferences of doctors, specifically with reference to Evidence Based Medicine (EBM) in the UK. This is particularly relevant during the current IT and resource development currently being undertaken in the NHS.

Mixed methods research techniques were utilised to gather and analyse the data collected to met the aims and objectives of this study. Three data collection methods have been utilised. The first utilised Clinical Librarians to count the information needs (questions) of doctors (Clinical Librarians Logs). The second data collection method gathered clinical questions from clinical librarians (specialists), medical librarians (generalists) and from websites hosting clinical questions (such as http://www.attract.wales.nhs.uk). These were analysed using the taxonomy developed by Ely et al. 2000. Finally an online questionnaire was used to gather data on doctors' awareness and use of electronic EBM resources.

The major finding is that research undertaken on the information needs in the healthcare sector in the USA cannot be readily utilised in the NHS.

This research utilised a unique data collection technique, the Clinical Librarian as a data collector. This enabled the quantification of doctors unperceived information needs.

This research identified that doctors in the UK asked roughly one question for every four patients seen. Despite the advances and ease of use of electronic resources, the preferred information source was colleagues. Time continues to be the major barrier for accessing electronic information to aid clinical decision making.

Keywords: Information needs, doctors, information-seeking behaviour, Evidence Based Medicine, NHS, electronic resources

DEDICATION

I dedicate this work to the loving memory of my father, David Charles Davies. I wish that he could have lived to see this work. This work is also dedicated to my mother, Rosemary Hutton Davies, for her support, encouragement and sacrifices during this PhD journey.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation for the time given by all my supervisors. To Anne Goulding, for her initial input that prompted me to start writing (prior to her maternity leave). To Wendy Olphert, for agreeing to be the second supervisor for the last eighteen months and for really making me think "outside" the NHS and "doctor" boxes. To Dr Janet Harrison, whose friendly supervision made the whole research process an enjoyable and fulfilling experience. Her professional support and friendship throughout the research process has been invaluable. I would also like to thank my Research Director, Professor Ron Summers, who has provided a useful sounding board and direction at the annual reviews.

I wish to acknowledge and thank all those who participated in this research. Without them this work could never have been completed.

I would also like to express my sincere thanks to my mother for her continuous encouragement and support throughout the PhD process. This includes all the "unpaid" assistance such as proof-reading and tea-making.

I am also grateful to the Department of Information Science for their financial support for my PhD study.

I also wish to acknowledge all those who assisted and contributed towards my PhD; especially those who have helped me during my research, but who have not been individually mentioned here.

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1 Introduction

This introduction provides the background to this study and outlines the aims and objectives of the research. Study justifications and limitations are also outlined. Definitions of the key terms used in the research are included in this chapter.

This is the first study that has quantified and analysed doctors' clinical information needs in the UK. This research integrated previous research to investigate the next stage of the process, the doctor's information-seeking behaviour.

This study is completely independent and has not been unduly influenced by external bodies. The Department of Information Science contributed to the costs of this research, but did not influence the content. Other organisations with a potential interest in the results, such as the Department of Health and National Library for Health were not aware of this research.

1.1 Background

Evidence Based Medicine (EBM) is a recently classified phenomenon. However, a multitude of electronic resources have been developed that are purported to be EBM focussed. This has coincided with a rapid increase in computer access, use and literacy, both personally and in the work context.

1.2 Previous Research

There has been little research in information needs and information-seeking behaviour of doctors undertaken in the UK. The most research has been in the area of EBM (Evidence Based Medicine) with studies published by O'Donnell

(2004), Freeman & Sweeney (2001), Cowling, Newman & Leigh (1999), Pyne et al. (1999), Lewis, Urquhart & Rolinson (1998) and McColl et al. (1998). Work has previously been undertaken on the sources utilised by doctors, though many of these were before the development of the electronic National electronic Library for Health (pilot launched in November 2000 and redesigned with a new URL, http://www.library.nhs.uk/Default.aspx, in January 2007) and focussed on just a few of the resources available (Meats et al., 2007; Tovey & Godlee, 2004; Wilson, Glanville & Watt, 2003; Ram & Wellington, 2002; McColl et al., 1998; Sackett & Straus, 1998; Prescott et al., 1997). Information needs have received little recent attention by UK researchers, with both studies focussing on general practitioners (Swinglehurst, 2005; Bryant, 2004). There has been no work undertaken in the UK to quantify the number of clinical questions doctors pose in the patient care situation.

The literature review highlights the research already undertaken on information needs, literature searching and information sources utilised by doctors. Work has been undertaken in the Middle East and Africa (Khoja & Al-Ansary, 2007; Shuval et al., 2007; Ajuwon, 2006; Al-Baghlie & Al-Almaie, 2004). However, these are completely different environments to that of the UK and the studies are therefore not comparable. There is a heavy American focus to the remaining work. The medical systems are distinctly different between the USA and UK. The US fee-paying healthcare system is not comparable to the NHS with its principle of free healthcare at the point of delivery. This is particularly applicable in the different interfaces between primary and secondary care. Therefore, it is not appropriate to rely on the American research evidence to predict the information needs of doctors in the UK.

1.3 Aims and Objectives

The aim of the research is to determine the information-seeking behaviour, needs and preferences of doctors, specifically with reference to Evidence Based Medicine (EBM) in the UK.

The objectives of the research are:

Information Needs

- To quantify the information needs of doctors;
- To understand the types of information needs of doctors;

Information-Seeking Behaviour

- To understand the preferences of doctors in locating evidence;
- To determine doctors' awareness and use of electronic Evidence Based Medicine resources;
- To rank the perceived barriers for doctors accessing electronic information as an aid in clinical decision making;

Evidence Based Medicine

- To identify the attitudes of doctors to Evidence Based Medicine;
- To determine the understanding doctors have of specific Evidence Based Medicine terms.

1.4 PhD Thesis Structure

This introduction provides the background to this study and outlines the aims and objectives of the research. Study justifications and limitations are also outlined. Definitions of the key terms used in the research are included in this chapter.

The literature review contains five sections. The first three sections consider the clinical information needs of doctors, their information searching and then the resources doctor utilise to locate evidence for patient care. The last two, "Evidence Based Medicine" and "IT in the NHS" outline the background and context of this research.

The methodology chapter considers the theoretical framework for this research. The practical research undertaken is also outlined.

The results chapter analyses the data collected by the method of collection, namely, the clinical librarian's log; questions collected by medical librarians, clinical librarians and from specific websites; and the online questionnaire.

The discussion chapter considers the results according to the objectives outlined in this introduction.

The conclusions and recommendations chapter considers the objectives of the research (and whether these were met). Recommendations are provided and contributions to the literature highlighted. Further potential research is also identified.

1.5 Framework of the PhD

The PhD covers three distinct areas (information needs, information seeking behaviour and Evidence Based Medicine) using three data collection techniques (Clinical Librarian's log, clinical questions from librarians / websites and an online questionnaire). The framework for this PhD is described below.

1.5.1 Information Needs

1.5.1.1 To quantify the information needs of doctors

This research quantified the need by counting the number of doctors present, the number of patient cases discussed and the number of clinical questions raised. This produced a ratio which was then extrapolated for all registered doctors in the UK.

This is the first research to quantify doctors' clinical information needs in the UK. This is also the largest study of doctors (655) and their information needs.

This research was completed using the symbolic interactionist approach. The quantitative research technique utilised was a Clinical Librarian's log. This is an untested data collection method. Due to the data collection method (clinical meetings and ward rounds) data were only collected from acute sector doctors.

1.5.1.2 To understand the types of information needs of doctors

The information needs of doctors were qualified by analysing clinical questions. Two methods were used; firstly determining if the question was foreground or background; secondly mapping the questions using an existing taxonomy (Ely et al., 2000) derived from primary care practice in the USA. The questions are broken down into category and then sub-sections. This research identified gaps and mapped on to the existing taxonomy by adding new categories. This involved both quantitative and qualitative research. This research was undertaken within the context of symbolic interactionism.

This is the first research:

- of this type in this area in the UK;
- into the acute sector generally;
- to compare acute and primary sector doctors.

This research utilised more questions than the research undertaken by Ely et al. (2000) and González-González, et al. (2007).

The data collection involved e-mailing medical librarians for clinical questions and also locating questions from suitable websites, such as ATTRACT (http://www.attract.wales.nhs.uk/).

1.5.2 Information seeking behaviour / Evidence Based Medicine

This research was comprehensive, integrating previous research. The whole information process from the "information need" to the "method of locating the evidence" and "resources utilised" was investigated.

This involved both quantitative and qualitative research. The interpretive paradigm was the theoretical framework behind this research.

This is the first cross-sector (both primary and acute) research.

The research technique utilised an online questionnaire to ensure anonymity. Doctors were recruited via e-mail.

1.6 Definitions

Clinical Information Need - The need for information by doctors in the patient care setting as a tool to manage the patient's care. This is a different process from information use in an academic setting for teaching, research and publication.

Doctor - This paper will refer to the "doctor" which in this context will include all qualified medical and surgical staff, including GPs (General Practitioners).

Evidence Based Medicine (EBM) - apply judgments about the quality of evidence, to those aspects of healthcare that require independent and logical assessments of the risks and benefits of treatments (or no treatment).

1.7 Justification for this Study

There is little published quantifiable evidence that doctors in the UK have clinical information needs. Medical librarians have undertaken literature searches to provide evidence for questions posed by doctors. These may have been counted. However in the UK, the number of questions asked per doctor (or number of questions raised per patient case) has not been researched. Whilst there is an obvious clinical information need in the UK, this research aims to provide initial quantification.

The Department of Health and National Library for Health are providing access to electronic resources. Evaluation of usage has been undertaken (Honeybourne, Marriott, & Morley, 2006), but little work has been undertaken in the UK to determine doctors awareness and perception of these resources. This research focuses on the awareness and perceived use of specified electronic EBM resources by UK doctors.

This research focuses only on the clinical information needs of doctors. Doctors actually have many information needs in the real world. Pluye et al. (2007) considered the reasons doctors searched for information in clinical practice. These included education, research, general interest, sharing information with patients and exchanging information with other health professionals. The top reason was to answer a clinical question. However, that research did not specifically analyse nor categorise the clinical question itself.

Central funding for resources such as the Drug and Therapeutics Bulletin and Clinical Evidence has been removed due to cost, but at the time no research was undertaken to determine doctors' awareness and use of these resources. Conversely, resources such as DynaMed have been purchased without determining doctors' awareness or knowledge of this resource.

2 Literature Review

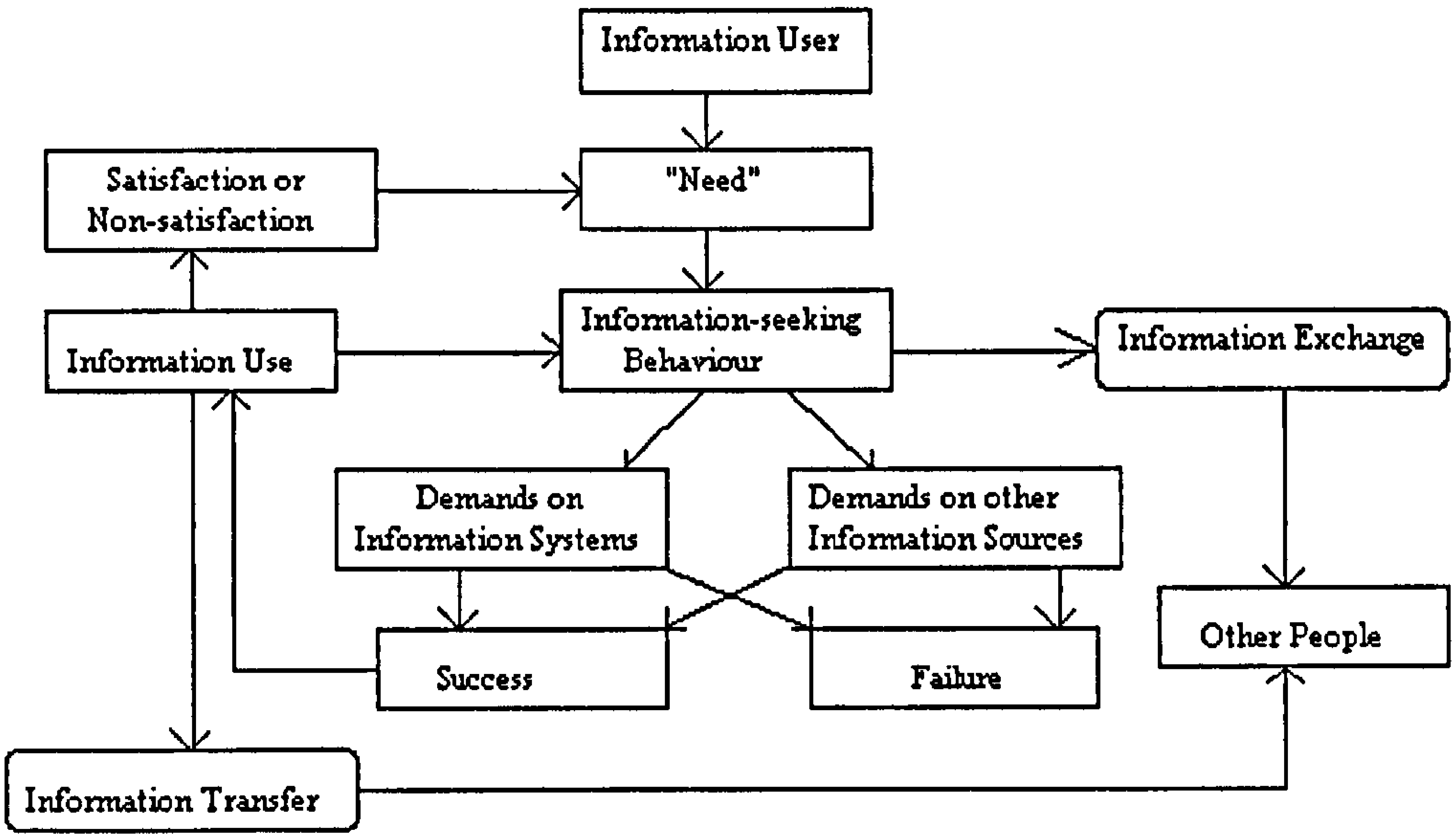
The literature review contains five sections. The first three chapters consider the clinical information needs of doctors, their information searching and then the resources doctors utilise to locate evidence for patient care. The last two, "Evidence Based Medicine" and "IT in the NHS" outline the background and context of this research.

2.1 Information Needs of UK Doctors

2.1.1 Information Behaviour: Need, Want and Use

To comprehend fully the information seeking behaviour of doctors, it is important to understand their information needs. Information needs are the driving force behind literature searching and literature retrieval. In the simplest terms, without an information need there would be little reason for a doctor to undertake a literature search. The importance of "need" and its pivotal role in information seeking is illustrated in the model by Wilson (1981, p.2), Figure 2.1. This model also acknowledges that information may be sought from "information systems", "information sources" or informally from "other people". There is no arrow away from "other people" so people are not considered to be a resource. However, in the medical environment colleagues are considered to be useful resources. Wilson (1981) also does not include an arrow away from failure, so if the attempt to locate information is unsuccessful at the first attempt then the search is abandoned. This may occur in the "real world", but if time permitted a new search may be instigated or the search referred to an information professional for them to attempt to locate the relevant information.

Figure 2.1: A Model of Information Behaviour (Wilson, 1981, p.2)



The issue of differentiating between needs, wants, demands and uses has been considered in the literature since the 1970s. A "need" can be defined in terms of what an individual "ought" to have, whereas "want" is what an individual "would like" to have. The "demand" is what an individual "asks for" and "use" covers what is actually utilised, namely a "satisfied demand" (Line, 1974, p.87). Research surveys often confuse information "needs" with information "uses" (Urquhart, 1997, p.8).

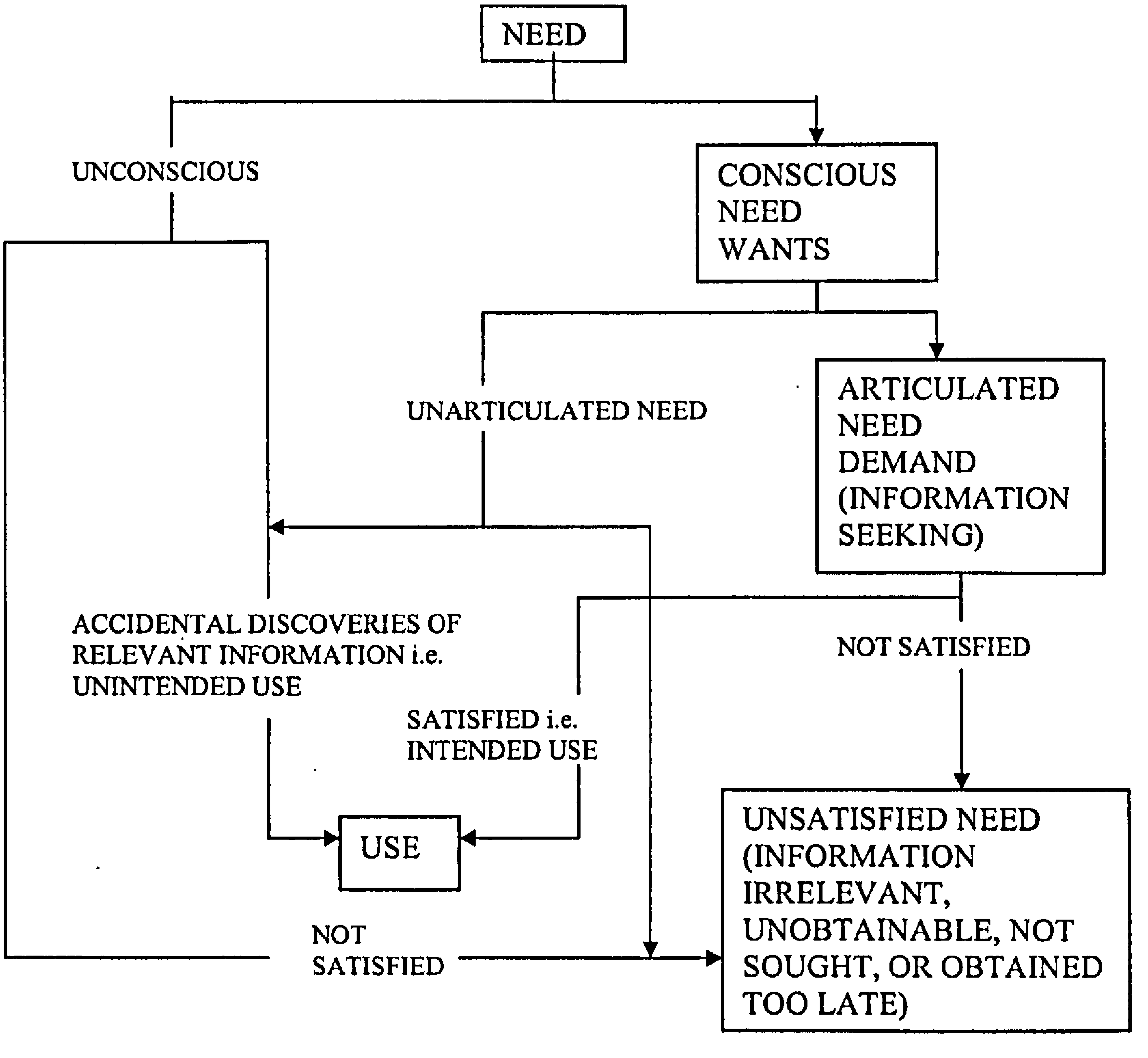
There are various types of need. The most recognisable is the "articulated" need, which is an actual "recognised" (Gorman, 1995) need that demands an answer (Lor, 1979). This is an "explicit" information need as the doctor is aware of the information need (Braun et al., 2007). A "pursued need" is where information is actually sought to answer the need (Gorman, 1995).

"Unperceived" needs are "unrecognised" (Gorman, 1995) as information needs and so answers are not pursued (Buckland, 1988). This unawareness is an "implicit" information need (Braun et al., 2007). In other words, the doctor is unaware there is a gap in their knowledge. This is a potential problem for the effective practice of Evidence Based Medicine (Moyer, 2004).

Barrie & Ward (1997) define "questioning behaviour" as the route by which a doctor realises the need for information. Whether or not information needs are pursued depends on the individual's ability to identify their need and then to express the need in terms that are searchable by themselves or a third party.

Figure 2.2 illustrates the conscious (then acted upon) need and the unconscious need (Lor, 1979).

Figure 2.2: Relationship between the concepts need, wants, demand and use (Lor, 1979, p.6)

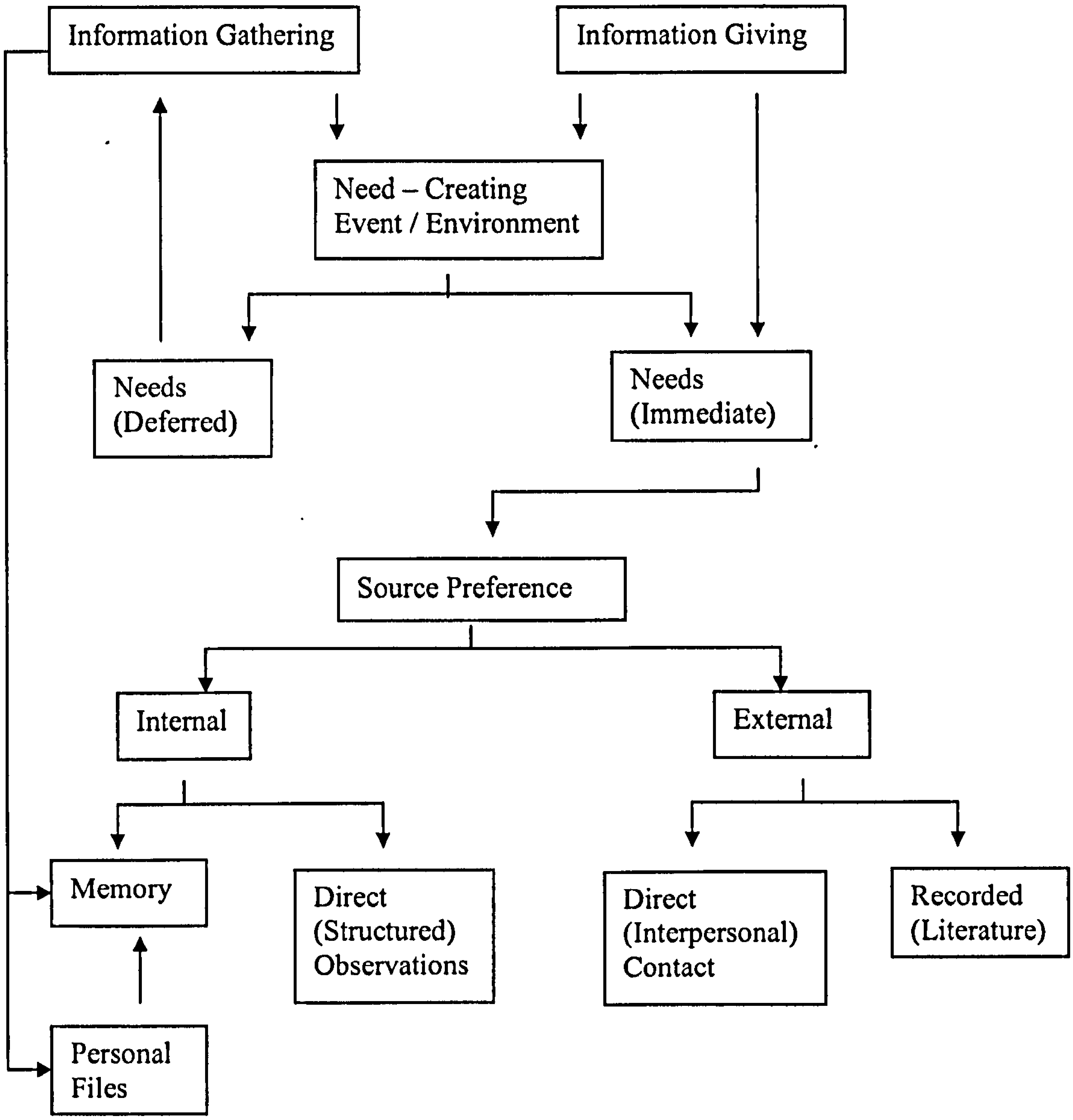


The models by Wilson (1981) and Lor (1979) both see the information need in isolation. External pressures such as the environment have not been considered. Issues such as time and access to resources do impact on "need" in the real world.

Taylor (1968) suggested a four-level information-seeking cycle. This included unexpressed (unperceived) need, conscious recognised need, expressed (articulated) need and the compromised (articulated in terms the system would understand) need. The compromised need is the actually query that is presented to the medical database for searching. Taylor appreciated that the context of the information need was important as different professionals may use information differently. This, as Lor (1979, p.6), links information need and information use.

The model (Figure 2.3) by Krikelas (1983) divides needs by time, into immediate and differed needs. Immediate needs are acted upon at the earliest convenient moment, whereas deferred needs are postponed to a later time. The "external" categories include formal "recorded literature" and informal contact with other people. This model also includes answering the information need through "memory" or "personal files". This tacit knowledge is difficult to measure. However, this knowledge is likely to increase the longer the doctor has been practising clinical medicine.

Figure 2.3: Information Seeking Behaviour (Krikelas, 1983, p.17)



Once a need has been identified, to address this, an individual moves through the "problem-resolution" process (Wilson, 1999, p.841):

- Problem identification or determining the kind of problem;
- Problem definition, which can be determined in medicine by the search strategy PICO (Patient, Intervention, Comparison, Outcome);
- Problem resolution, identifying where to find the information to answer the problem;
- Solution statement or the answer.

2.1.2 Information Needs in the Health Arena

Some articles have focussed entirely on the information needs of health professionals (Swinglehurst, 2005; Jerome et al., 2001; Dee & Blazek, 1993; Covell, Uman & Manning, 1985). However, most articles are written on information seeking behaviour, though often include an element on information needs (Cheng, 2004; Arroll et al., 2002; Ely et al., 1999; Barrie & Ward, 1997).

Doctors have diverse information needs. Most studies focus on clinical information needs rather than gaining data on the full range of information requirements (Bryant, 2000). Researching all the information needs of doctors would be a mammoth undertaking, both for the researchers and the participants. The clinical information need is relatively easily categorised and covers the main role of the medical staff, namely treating the patient.

An issue that affects information need is data overload. Doctors can progress from too little information to too much (often contradictory) information in one quick step (Slawson, Shaughnessy & Bennett, 1994). Advances in information dissemination, such as electronic newsletters and push technologies (information sent to the recipient without it being requested) have increased the amount of unwanted information that doctors receive during their working day (Gray, 1998). In fact, locating the actual information needed from the mass bombardment is a major problem facing all health professionals (Swinglehurst, 2005). It is a mistake to think information needs can be solved by merely providing access to all the information available in the world (White, 2000).

In the medical field, clinical information needs are principally generated by treating patients (Smith, 1996). In group discussions, half the participants mentioned that knowledgeable patients create information needs (Bryant, 2004). It would be impossible for medical staff to retain all the knowledge required to treat all the patients they examine over the course of their careers. A BMJ article suggests that experienced doctors utilise "two million pieces of information" in patient care management (Smith, 1996, p1062).

2.1.3 Doctors Information Needs Research

Table 2.1 compares research results to determine how many patient questions (information needs) are generated per patient encounter. All of the figures from the original articles (on patient encounters and number of questions) are included for transparency.

Table 2.1: Number of Questions per Patient Encounter

Author, Date	Country	Methodology	Clinical Setting	Clinical Group	No. of Patient Encounters	No. of Questions	Questions per Patient
Covell, Uman & Manning, 1985	USA	Post visit interview	Office Practice	Physicians (47)	409	269	0.66
Osheroff et al., 1991	USA	Observation	General Medicine (University)	Physicians / Medical Students (24)	90	454	5.04
Ely, Burch & Vinson, 1992	USA	Observation	Office Practice	Family Physicians (30)	602	41	0.07
Dee & Blazek, 1993	USA	Patient charts	Office Practice	Rural Physicians (12)	144	48	0.33
Giuse et al., 1994	USA	Patient charts	AIDS Clinic	Health Care Researchers	120	266	2.22
Gorman & Helfand, 1995	USA	Post patient interview	Office Practice	Primary Care Physicians (49)	514	295	0.57
Barrie & Ward, 1997	Australia	Post clinic interview	Office Practice	General Practitioners (27)	376	85[1]	0.23
Ely et al., 1999	USA	Observation	Office Practice	Family Doctors (103)	2,467	778	0.32

[1] Clinical questions only – total questions asked 119, including 28 organisational, 4 patient data and 2 ethical dilemmas.

Author, Date	Country	Methodology	Clinical Setting	Clinical Group	No. of Patient Encounters	No. of Questions	Questions per Patient
Cogdill et al., 2000	USA	Post patient interview	Community based Primary Care (educational sites)	Physicians (15) alone	148	62	0.42
				Physicians (15) with student present	154	45	0.29
Fozi et al., 2000	Malaysia	Unanswered questions	University Hospital Primary Care Clinic	Doctors (21)	7101	78	0.01
Green, Ciampi & Ellis, 2000	USA	Post patient interview	University based Primary Care	Residents (64)	401	280	0.70
Arroll et al., 2002	New Zealand	Observation	Office Practice	Family Physicians (50)	420	122	0.29
Ebell & White, 2003	USA	Self-reporting	Outpatient Office Practice	Physicians (35)	2,496	402	0.16
		Post visit interview		Physicians (27)	966	415	0.43
Ramos, Linscheid & Schafer, 2003	USA	Observation	University based Family Practice	Faculty members (11) Residents (25)	215	274	1.27
González-González, et al. 2007	Spain	Observation	Urban Primary Care	Family Physicians (90) Paediatricians (22)	3511	635	0.18

Author, Date	Country	Methodology	Clinical Setting	Clinical Group	No. of Patient Encounters	No. of Questions	Questions per Patient
McCord et al., 2007	USA	Observation	Hospital – affiliated to University	Family medicine residents (23)	328	532	1.6
Van Duppen et al., 2007	Belgium	GPs' searches	General Practice	GPs (5)	2920	365	0.13

The information needs of doctors are varied, ranging from 0.01 to 5.04 questions per patient. Alternatively, this can be described as: doctors ask one question for every two patients seen (Gorman & Helfand, 1995); or two questions for every three patients (Green, Ciampi & Ellis, 2000; Covell, Uman & Manning, 1985); two questions for every ten patients (Barrie & Ward, 1997); or one question for every fifteen patients (Ely, Burch & Vinson, 1992). This large range may be due to the different medical specialisms researched or to the different research methodologies utilised in the studies. These do hinder direct comparison of the results. The lowest figure of 0.01 (Fozi et al., 2000) was from a study that collected doctors unanswered clinical questions at the end of the clinical day. This is clearly not all the clinical questions asked since answered clinical questions were not included. The 0.07 figure was obtained by counting a question when the doctor was actually observed seeking information as the researchers focussed on information-seeking rather than questioning behaviour (Ely, Burch & Vinson, 1992). This explains that comparatively lower figure. The other relatively low figure of 0.123 (Van Duppen et al., 2007) is understandable as this is the actual number of electronic information resource searches doctors undertook, rather than questions asked (whether pursued or not). The researchers with the other low figure (0.18 questions per patient) identified the short duration of the patient appointments as having a negative impact on question raising (González-González, et al. 2007). Other studies included information needs identified but pursued later or not at all. However based on the data available it is not possible to determine definitive reasons for the varied results.

The average number of questions raised per patient visit from the research articles listed is 0.79. However the disproportionately high figure of 5.04 (Osheroff et al., 1991) and low figure of 0.01 (Fozi et al., 2000) do distort this average figure. The median figure is 0.38, which more accurately reflects the grouping of the results around this figure.

The Osheroff et al. (1991) study with the unusually high figure of 5.04 questions per patient counted all information requests. Of the 337 questions that focussed on patient care, 52% or 175 required a fact that was actually available in the patient record or hospital information system. The majority of the other studies did not include these questions. Therefore removing the patient record questions leaves 162 patient care questions, that is 1.8 questions per patient.

Gorman, Yao & Seshadri (2004) undertook a study to determine if the information seeking behaviour of primary care medical staff in rural areas was different to that in non-rural areas. The results showed there were no differences in terms of the number of questions asked, the number of questions pursued and the number of questions answered. This reinforced the earlier work by Dorsch (2000) who reached a similar conclusion.

Each methodology utilised has problems associated with it. Observation creates an unnatural environment and the observed may react differently to their normal working mode. Interviewing doctors may also actually encourage the creation of questions as it allows them to revisit the patient encounter and reflect back. Another data collection method, the questionnaire, is problematic as it relies on the recall of the respondent and their interpretation of the question posed. Self-reporting requires doctors to note responses during a busy clinical session, which may not be 100% complete due to time constraints and other distractions. The most effective study combines more that one method. Covell, Uman & Manning (1985) used both doctor self-reported questionnaires and interviews (post-patient and post-clinic). Cheng (2004) utilised mailed questionnaires, interviews and a randomized controlled study.

Observation was the chosen methodology for three research studies that resulted in higher than average questions, 5.04 (Osheroff et al., 1991), 1.6 (McCord et al., 2007) and 1.27 (Ramos, Linscheid & Schafer, 2003) per patient encounter. However, two other observational studies had results of 0.32 questions per patient (Ely et al., 1999) and 0.29 questions (Arroll et al., 2002). The different results between the two groups may be due to the clinical setting as McCord et al. (2007), Ramos, Linscheid & Schafer (2003) and Osheroff et al. (1991) were University based clinics, which are usually teaching settings.

Reviewing patient records has produced distinctly different results in the two studies featured, 0.33 (Dee & Blazek, 1993) and 2.22 (Giuse et al., 1994). In the Dee & Blazek (1993) study, the patient charts were reviewed and discussed with the consulting doctor. However, in the Giuse et al. (1994) study, the seven researchers were asked to think like a primary care provider to generate the questions. Whilst three of the researchers were doctors, only one treated HIV-infected patients routinely. Therefore, their questions would probably not have taken into sufficient account the knowledge that practising doctors possess.

Another problem with these studies is that most involved small sample sizes. Ely et al.'s (1999) study was the only one involving more than 100 doctors. Both Ely et al.'s (1999) and Ebell & White's (2003) studies were the only two that counted more than 1,000 patient encounters.

Even within the same environment, when the circumstances altered, so did the number of questions generated. The doctors asked fewer questions when students were present, 0.29 per patient compared to 0.42 when alone (Cogdill et al., 2000).

The doctors' perceived need for information was lower than their actual need. When the doctors completed a self-reporting questionnaire they believed they needed information on average once a week, but the post-patient interviews produced an average of two questions for every three patients seen (Covell, Uman & Manning, 1985). Another study also found that interviews after the patient visit identified more questions than self-reporting by doctors (Ebell & White, 2003).

A study by Ely et al. (2005) counted the number of questions raised by doctors in a half-day observation period (4 hours). On average doctors asked 5.5 questions per half-day. Unfortunately the number of patients seen per session was not quantified in the article.

Despite the varied numbers, these research articles demonstrated there is an information need generated by patient visits. One review of the literature suggests that patient encounters usually generate at least one question (Smith, 1996, p.1062).

2.1.4 Types of Information Required by Doctors

Table 2.2 shows the types of information required by medical staff. Responses that are not comparable to other studies have not been included. Only responses found in three or more studies have been included. Therefore, not all the responses are shown for each study.

It is difficult to compare the results from these studies due to the different definition of terms; varied subjects; range of settings; and diverse methods of data collection. However, basic analysis suggests that the top categories are treatment or therapy (average 41.1%), diagnosis (24.8%) and drug therapy / information (24%). The VALUE study identified a ratio of 1:2 for diagnosis to treatment since 53% of the questions were on treatment and 27% diagnosis (Urquhart & Hepworth, 1995).

The nineteen research studies reviewed used over forty different definitions to analyse their data. However all the studies used "diagnosis" and eighteen used "treatment" or "therapy". "Drug therapy" or "drug information" was used in nine of the studies. Aetiology was also used in nine studies.

Two research studies divided the questions raised into three specific areas. Medical fact, such as the reported side effects of a prescribed drug, accounted for 40% (Covell, Uman & Manning, 1985) or 50% (Arroll et al., 2002) of the questions. Medical opinion, for example patient management, answered 43% (Covell, Uman & Manning, 1985) or 30% (Arroll et al., 2002). The remainder, 17% and 20% respectively, related to non-medical information.

Table 2.2: The Type of Information Required by Medical Professionals

	Aetiology	Diagnosis	Disease	Drug therapy	Epidemiology	Patient interaction	Prevention	Prognosis	Treatment / therapy
Covell, Uman & Manning, 1985		25%	6%	14%		8%			31%
Ely, Burch & Vinson, 1992		27%		49%					73%
Dee & Blazek, 1993	8%	15%							75%
Giuse et al., 1994		19%[2]	22%[3]	22%[4]		1%			25%
Chambliss & Conley, 1996		29%		15%				6%	37%
Ali, 2000		10%		27%		47%			27%
Cogdill et al., 2000 - alone	5%	23%		29%	19%				
Cogdill et al., 2000 – with student	2%	33%		20%	18%				

[2] Study actually lists diagnosis and aetiology together and efficacy of diagnostic procedure 2%
[3] Includes both disease complication and disease description
[4] Includes adverse effects 11%, information 7% and efficacy 4%

	Aetiology	Diagnosis	Disease	Drug therapy	Epidemiology	Patient interaction	Prevention	Prognosis	Treatment / therapy
Ely et al., 2000		38%			9%				44%
Fozi, et al., 2000		31%		14%				6%	24%
Green, Ciampi & Ellis, 2000		25%	2%	6%	15%		6%	8%	35%
Jerome et al., 2001	3%	5%	31%			2%		3%	53%[5]
Swinglehurst, Pierce & Fuller, 2001	10%	23%							67%
Arroll et al., 2002		33%	2%				2%		39%
Crowley et al., 2003	9%	22%						9%	53%
Ebell & White, 2003 - Self-Reporting		23%		50%	6%				8%
Ebell & White, 2003 - Post Patient Interview		29%		34%	8%				14%
Schwartz et al., 2003		9%			13%		11%	14%	50%
Cheng, 2004		7%						Yes	46%[6]

[5] Includes 36% treatment, 11% treatment adverse effects and 6% treatment efficacy
[6] Includes drug therapy

	Aetiology	Diagnosis	Disease	Drug therapy	Epidemiology	Patient interaction	Prevention	Prognosis	Treatment / therapy
Alper, White & Ge, 2005	4%	22%			4%		2%	3%	49%[7]
Bergus & Emerson, 2005		43%					10%	6%	36%
Magrabi et al., 2005	7%	40%		8%		10%			35%
Schilling et al., 2005	4%	15%					9%	3%	43%
González-González, et al., 2007		52%			1%				27%
Van Duppen et al., 2007		22%					15%	8%	55%

[7] Includes treatment (45%) and adverse effects of treatment (4%)

2.1.5 Analysis of Questions Asked by Doctors

Clinical information can be divided into two categories. The first is "declarative knowledge", that is "what to know". The second is "procedural knowledge", namely "what to do" (Florance, 1992).

Two research articles analysed the questions posed according to whether they were foreground (directly related to the patient, such as diagnosis, treatment and prognosis) or background (general information on a condition or disease) in nature (Cheng, 2004; Green, Ciampi & Ellis, 2000). The foreground question usually contains at least three out of these four elements: patient or problem; intervention; comparison with intervention; and outcome. The background question has a "question root" of who, what, why, when, where or how (Mendonça et al., 2001, p.89). The more senior the medical professional the more likely the question will be foreground. This is understandable, as their background knowledge would have developed through experience. Table 2.3 shows the results from research by Cheng (2004) and Green, Ciampi & Ellis (2000) are similar when considering the senior doctors (consultants).

Table 2.3: Comparison of Background and Foreground Questions (Cheng, 2004; Green, Ciampi & Ellis, 2000)

	Background Questions	Foreground Questions
Cheng, 2004	33% consultants 57% senior medical officers 45% medical officers	67% consultants 43% senior medical officers 55% medical officers
Green, Ciampi & Ellis, 2000	28%	66%

The practice of Evidence Based Medicine can assist with the foreground questions as they focus on individual patient clinical decisions. Medical textbooks can generally answer the background questions (Craig, Irwig & Stockler, 2001).

Ely et al. (2000) produced a taxonomy of clinical questions by analysing questions raised by American primary care doctors. The taxonomy consists of sixty-four categories under the headings Diagnosis, Treatment, Management, Epidemiology and Non-Clinical (full taxonomy in Appendix I).

Braun et al. (2005) produced 167 information-need templates to classify doctors' questions; for example, "Does [CHEMICAL] cause [SIGN or SYMPTOM]?" and "What are the side effects of [CHEMICAL]?" These break down the questions to their core components in a similar fashion to the taxonomy created by Ely et al. (2000).

2.1.6 Patient Care Questions

Three research articles identified that 98% (Shelstad, 1996), 81% (D'Alessandro, Kreiter & Peterson, 2004) and 74% (Osheroff et al., 1991) of questions related to patient care. The "evidence cart" survey in the UK found that 81% of the evidence sought affected diagnostic and / or treatment decisions (Sackett & Straus, 1998). Doctors in New South Wales, Australia, used CIAP (Clinical Information Access Program) 75% of the time for clinical reasons, such as confirming a diagnosis, developing a treatment plan or selecting a diagnostic test (Westbrook, Gosling & Coiera, 2004). However, another survey found that 254 out of 804 responses (just 32%) focussed on clinical questions or problems (Cheng, 2004). The purpose of searches by doctors in a study (after decentralised Medline was introduced) was only for patient care 10% of the time, research 30% and for both (research and patient care) 53% of the time (Darmoni et al., 2000).

Pilot studies for the VALUE project suggest that often information needs answered by the health library were for education and research needs, rather than a specific patient. However, that information may be used in the future for patient care (Urquhart, 1997). Unfortunately research studies are unlikely to take into account information obtained for other reasons that may ultimately be utilised in patient care management. The time scale of research would not allow this information to be monitored in the long term to determine if it ultimately was utilised for patient care. Since not all the information is utilised inpatient care management, this suggests that medical professionals have information needs that are outside the boundaries of immediate patient care.

A study of primary and secondary care doctors in the UK considered their reasons for changes in clinical practice (Allery, Owen & Robling, 1997). The research found that changes in general practitioners' behaviour was prompted on average by 3.2 reasons; whilst for hospital consultants the figure was 2.8. Only 13% of the changes were due to just one reason. The top three reasons for change were organisational factors (18%), education (17%) and contact with professionals (13%).

2.1.7 Health Care Setting

Many of the studies, especially those from New Zealand, Australia and the UK, focus on primary care doctors (Magrabi et al., 2005; Swinglehurst, 2005; Arroll et al., 2002; Ely et al., 1999; Barrie & Ward, 1997). These studies, particularly that by Ely et al. (2000) who produced a taxonomy of clinical questions for American primary care doctors, may not be relevant for other professional groups of doctors. However, it should not be assumed that any professional group is cohesive enough to be a distinct unique group (Booth, 2000). Therefore research in other professional fields may in fact produce similar results to Ely et al. (2000).

The USA based studies are often conducted within office practices, but these are not necessarily general practitioners as a wide variety of specialists work in these environments, such as cardiologists, gastroenterologists, endocrinologists, rheumatologists and infectious disease specialists (Covell, Uman & Manning, 1985).

There has been research conducted in hospital-based environments, though not to the extent of investigations into primary care work (Cheng, 2004; D'Alessandro, Kreiter & Peterson, 2004; Green, Ciampi & Ellis, 2000; Giuse et al., 1994).

2.1.8 Doctors' Information Needs in the UK

One research study ranked the information needs of doctors in the UK, but unfortunately did not provide any statistics to compare with other studies (Bryant, 2004). In order of importance the perceived information needs of GPs were:

1. Clinical care;
2. Keeping up-to-date;
3. Information for patients;
4. Pharmacological information
   Gaps in knowledge;
5. Curiosity;
6. Uncertainty.

2.1.9 Relation between Information and Time

One final aspect of information need is the time-element associated with the information. Some information is particularly time-sensitive, especially if it influences patient care. Research indicates there are two speeds at which information is required. The first is immediate; the "bottom line" required when dealing with immediate patient care, followed by the less-immediate morning rounds, case consultations and discussions with colleagues (Gray & De Lusignan, 1999).

One study suggested 39% of information was required within 24 hours, of which 5% was required immediately. Fifty-four percent of the information was required within the week (Strasser, 1978). This information may be used for education, research, or to confirm / review a treatment regime. Klein et al. (1994) identified that when searches were completed earlier in the patient's hospital stay, costs were lower and the length of stay shorter than those whose searches were conducted later.

Information is required 24/7, 365 days per year (Freeth, Weist & Roberts, 2001). This need for information at any time does suggest that electronic resources and the ability to access them effectively are important requirements for doctors.

2.2 Information Seeking Behaviour of UK Doctors

2.2.1 Introduction

The actual mechanics and skills of literature searching are extensive and will not be covered to any great extent in this chapter. The concepts that are explained will only be to provide background or explanatory information.

A health professional may have many work roles, including patient care provider, researcher, educator, counsellor, manager and administrator (Urquhart, 2000). From these roles many tasks are derived such as treating patients and maintaining their records. These tasks may generate information needs such as locating evidence on treatments and diagnostic tests.

Figure 2.4: A Model of the Information Seeking of Professionals (Leckie & Pettigrew, 1997, p.100)

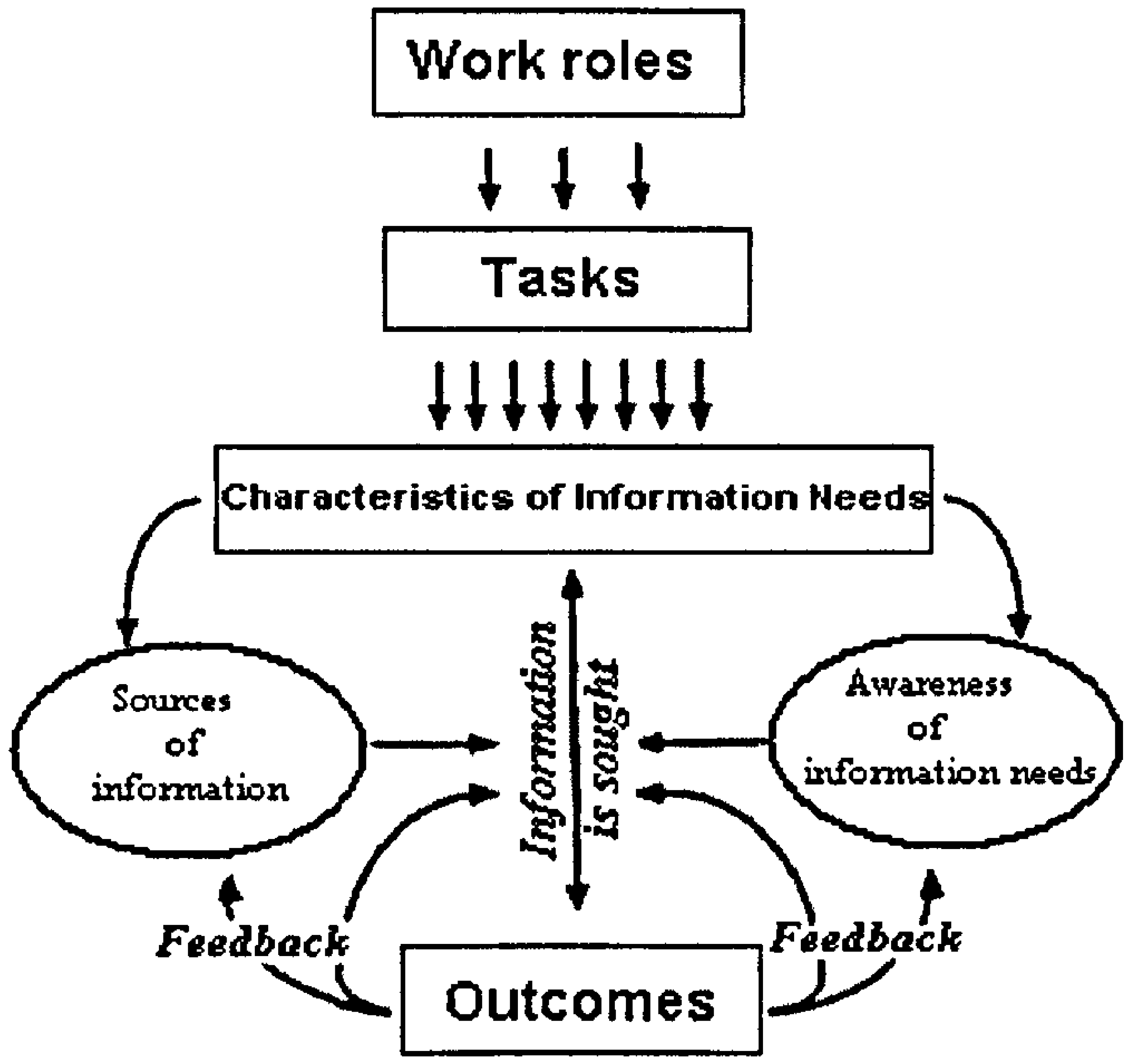
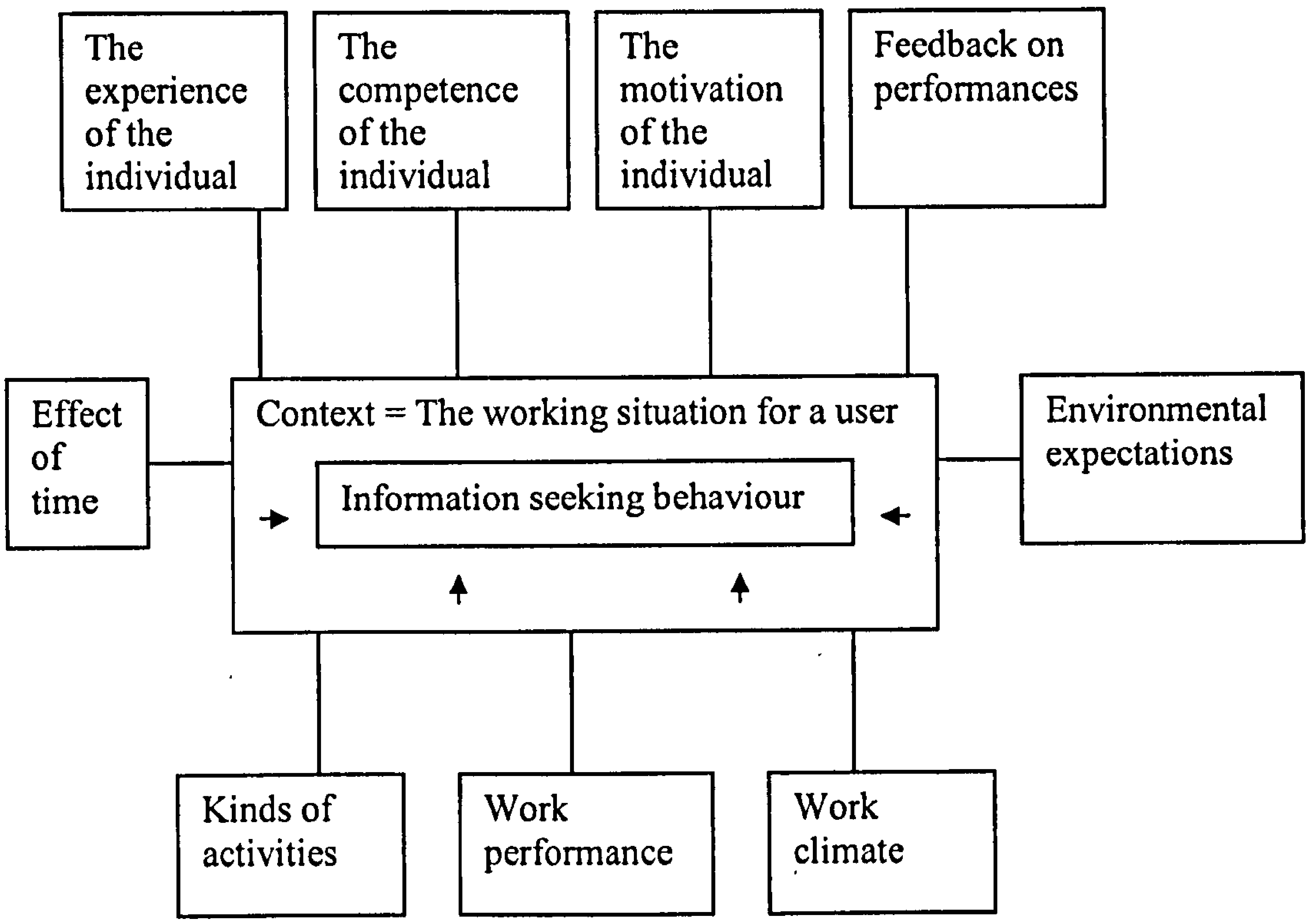


Figure 2.4 illustrates a model of information seeking, based on the different elements involved in the process of a professional work-related need. The "sources of information" may be formal (journal articles) or informal (conversations with colleagues). The "awareness of information" needs are affected by prior success, trustworthiness and accessibility of the information source. The "outcomes" are the results of the information seeking process. If the need is not satisfied and further information seeking is required then the "feedback loops" can be utilised (Leckie, Pettigrew & Sylvain, 1996, p.184-7).

The environment impacts on the information searching behaviour of individuals. Figure 2.5 illustrates factors that impact on the context and user's information seeking behaviour (Malmsjö, 1996, p.229). The top row highlights the importance of the individual's skills, experience and enthusiasm to search for information. Time and environmental expectations can, in some circumstances, actually act as constraints. The final row shows the impact of the working conditions which may have a large impact on users, particularly within an institutionalised setting, such as the NHS.

Figure 2.5: Factors Influencing User's Information Seeking Behaviour (Malmsjö, 1996, p.229)

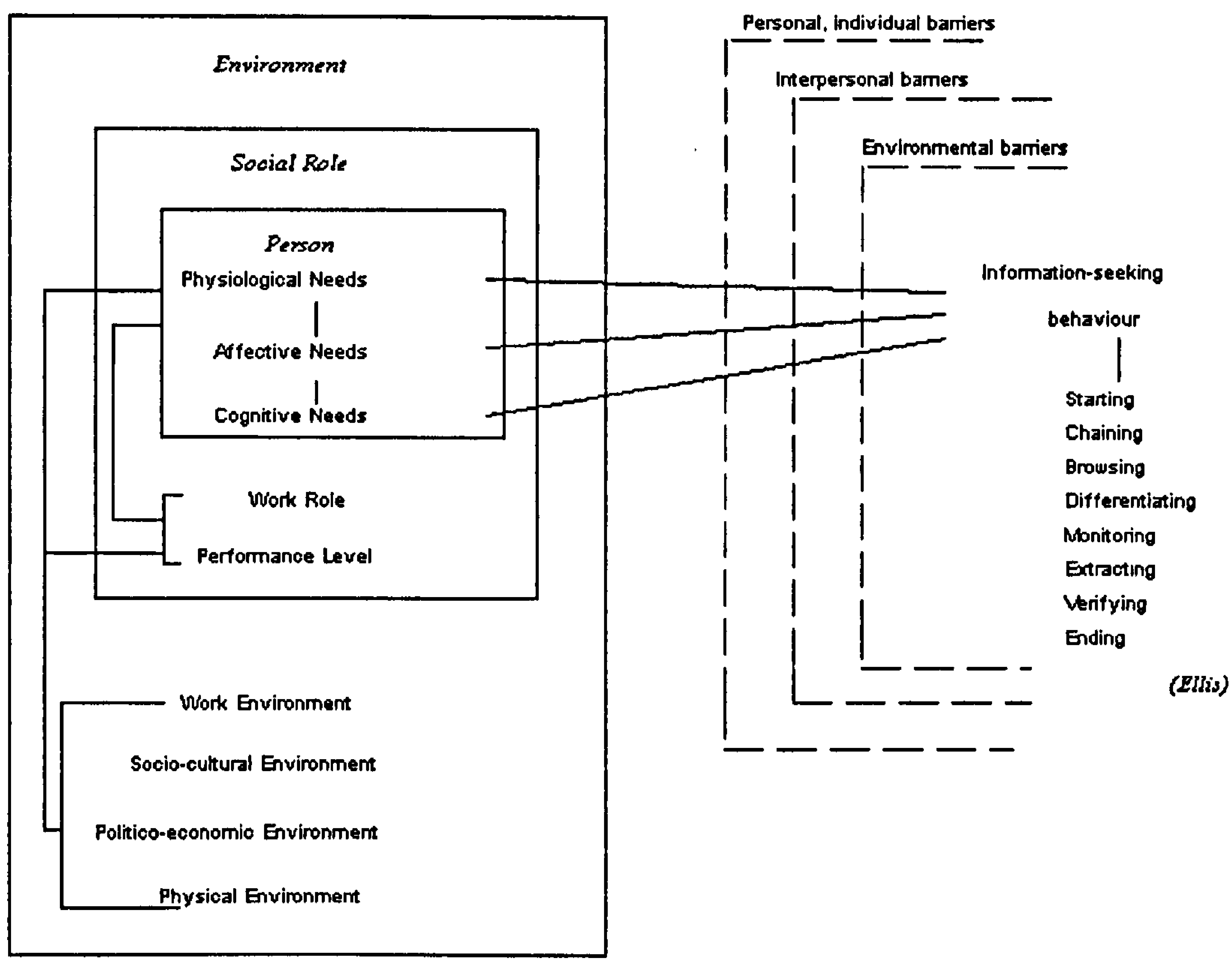


However whilst environment is important, the literature searching or as described in Figure 2.6, the information-seeking process is derived from the needs of an individual person. The actual procedure of searching for information was described by Ellis & Haugan (1997) and consists of eight components:

- Starting or surveying – to gain an overview of the topic;
- Chaining – following footnotes and citations;
- Browsing;
- Differentiating – information sources are ranked according to their importance;
- Monitoring – keeping up-to-date;
- Extracting – filtering to select relevant material;
- Verifying;
- Ending – tying up loose ends.

This process is complicated enough, but must also fit into the environment in which the doctor works.

Figure 2.6: The Information Seeking Process (Wilson, 1994, p.18)



There is a distinct difference between looking up a fact and literature searching. This is often not differentiated in research on doctors information needs. Looking up the dosage for a prescribing drug is an information need of the doctor. However, this can easily be located in the BNF (British National Formulary) so does not require an extensive search of the literature.

2.2.2 Questions Posed

Evaluating the complexity of questions asked by doctors suggests that 68% of the questions are simple (one concept) such as the dose of a drug (Arroll et al., 2002). This type of question doctors should be comfortable answering with a minimal amount of training on computers and resource selection. User education should focus on resources that can be used effectively with minimal training, such as the BNF (British National Formulary) and the Cochrane Library (Holtum, 1999).

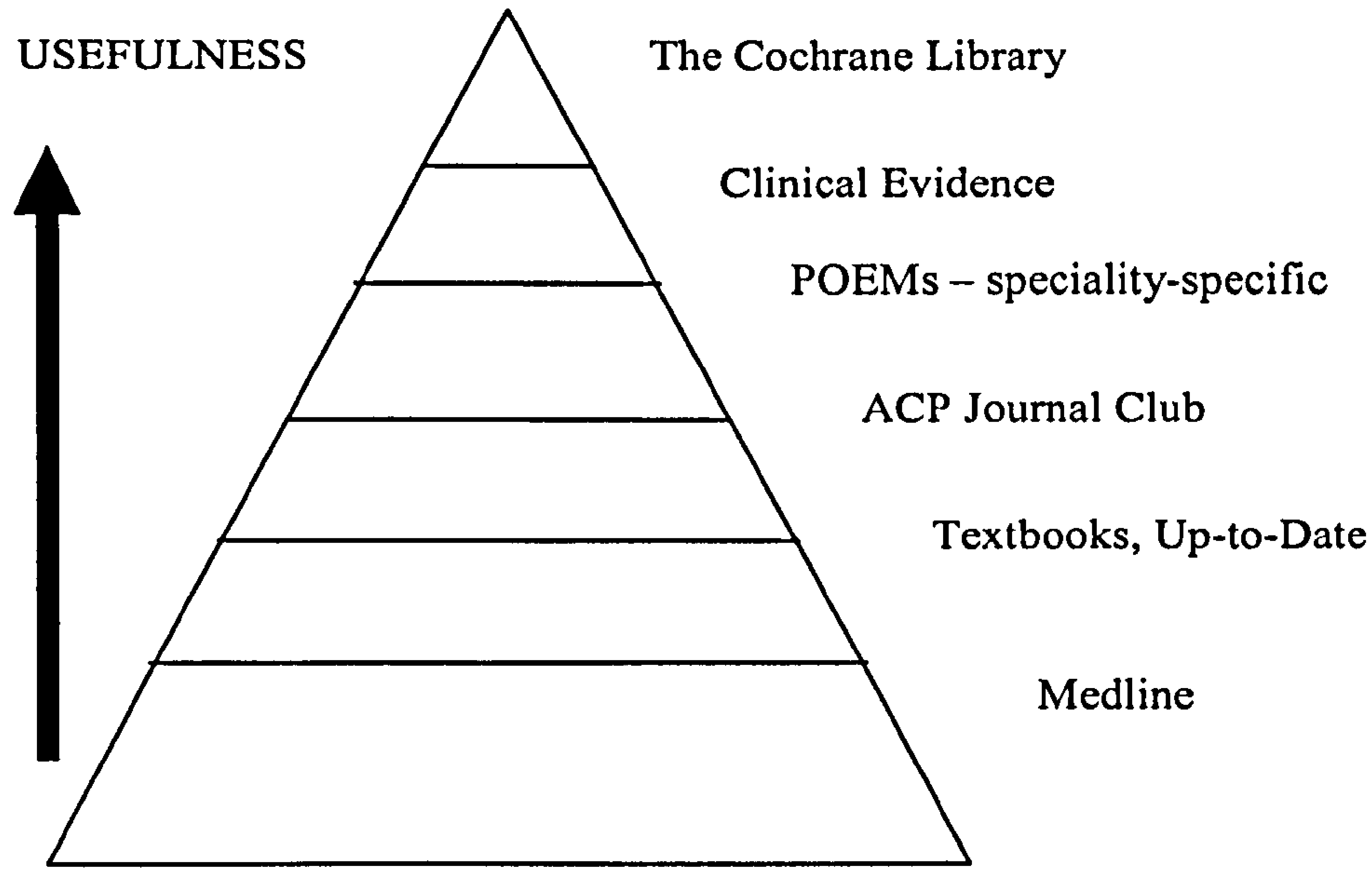
2.2.3 Resource Use

Information seeking in the twenty-first century, particularly for Evidence Based Medicine is focussed on the computer interface. Searching involves "human computer interaction" by using the mouse to follow links and "at the intellectual level" by combining an information search with Boolean operators (Wilson, 2000, p.49).

The argument that doctors only have time to complete "quick and dirty" searches due to time constraints is worrying. If the doctor only has time to read one or two articles, these should be the most relevant, retrieved by a skilled searcher (Holtum, 1999).

Speed is the most important aspect in searching the filtered evidence resources. The Cochrane Library provides the best evidence (systematic reviews) in a usable and understandable format. Whereas Medline contains information that has not been evaluated (Grandage, Slawson & Shaughnessy, 2002). The evaluation of the "raw" information from Medline can be time-consuming. Figure 2.7 illustrates the usefulness of resources, ranked in an order suggested by Grandage, Slawson & Shaughnessy (2002).

Figure 2.7: Pyramid of Useful Resources (Grandage, Slawson & Shaughnessy, 2002, p301)



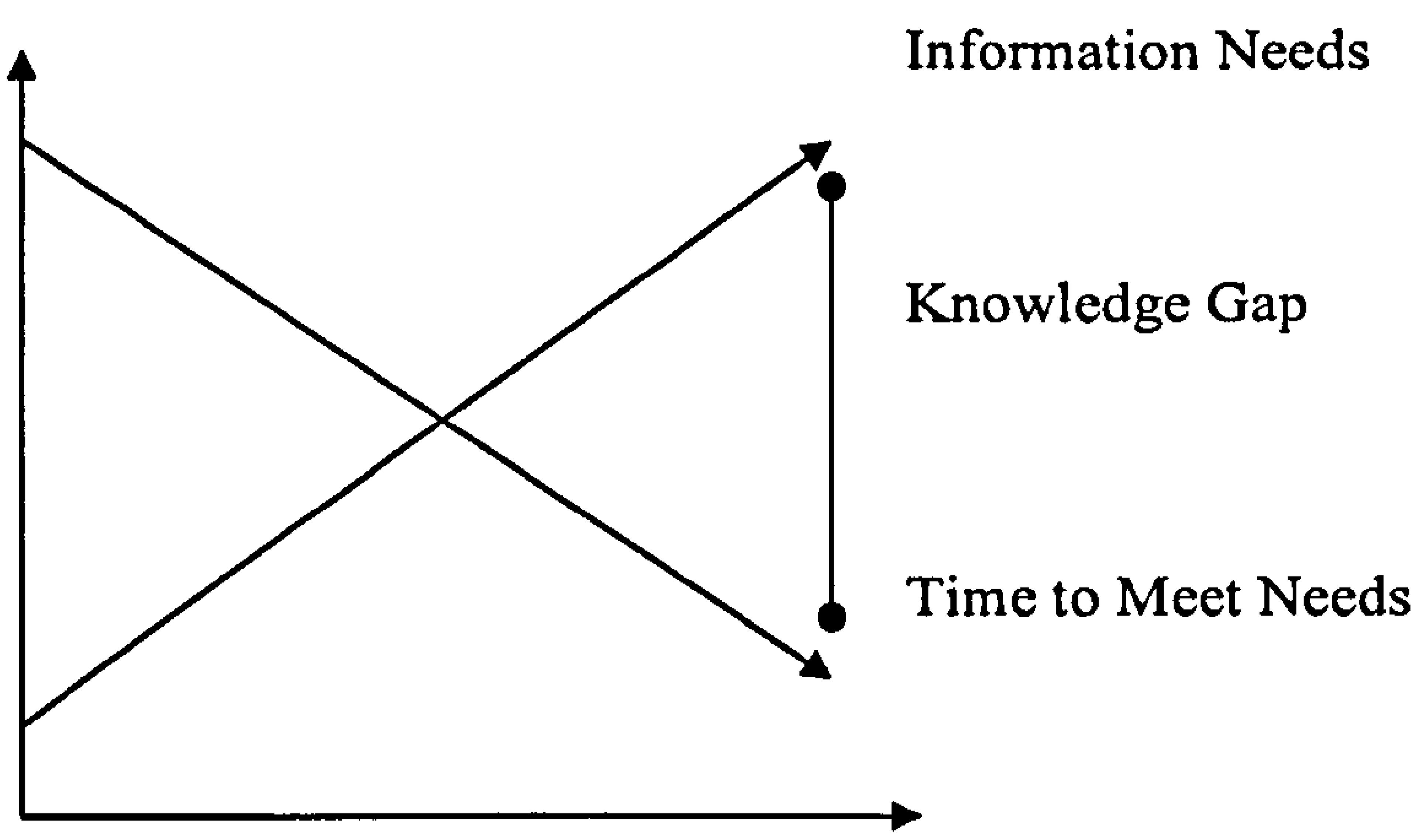
In a study of rural doctors, 75% indicated they were not interested in personally searching bibliographic databases, nor were they interested in personal computing and instruction on literature searching (Dee & Blazek, 1993). Doctors routinely delegate clerical work and so it is understandable that they are willing to assign their literature searching to the professionals in this area, the librarians.

2.2.4 Barriers to Literature Searching

2.2.4.1 Managerial Barriers

Basically there is no time allocated in the working day for searching for evidence. Therefore a key barrier to information searching is time. In one study, a third of doctors felt a lack of time was a barrier (Covell, Uman & Manning, 1985) and in another 60% felt time was an issue (Green, Ciampi & Ellis, 2000). Research by Cogdill et al. (2000) found that 40% of questions were not pursued due to a lack of time. The issue of time is illustrated in Figure 2.8. As information needs grow the time to answer these needs reduces, described by Berkowitz (2002) as a "knowledge gap".

Figure 2.8: The Knowledge Gap (Derived from Berkowitz, 2002, p.2)



2.2.4.2 Technical Barriers

A major barrier to accessing up-to-date relevant information sources is the lack of access to a computer or the Internet / NHSnet. However, even if access is available, slow Internet connection can act as a barrier, since it lengthens the time required to complete the search (Schwartz et al., 2003).

2.2.4.3 Educational Barriers

A study focussing on the use of computer software to answer questions identified many problems faced by users. These included difficulties navigating the software, poor search techniques and difficulty interacting with the software (Osheroff & Bankowitz, 1993). This survey did predate the more user-friendly Windows environment. However a more recent study by McKibbon & Fridsma, published in 2006 identified issues with ineffective search methods and unwise resource selection. A recent survey of general practitioners found that 80% rated their computer skills as "good" or "better" (Magrabi et al., 2005). This initially sounds promising as computer skills are important but these must be matched with good searching skills and knowledge of electronic database resources.

There are several potential barriers associated with the information sources themselves. A lack of knowledge of the sources available has been identified as an obstacle (Shelstad, 1996). Unfamiliarity with the computerised resources means searching could potentially take even longer as a suitable resource has to be located first. Osheroff & Bankowitz (1993) also found that appropriate resource selection was problematic. This is not surprising, as resources have not been marketed that heavily by libraries (Clifford, 1986). This "channel-selection" or identifying where to look for information is one of the barriers identified by Buckland (Buckland, 1988, p188). This is particularly relevant in the medical sector where doctors answering patient care questions need to be aware of the benefits of searching "clinically-oriented resources" (Ely et al., 2007, p.407). In the UK this issue is being addressed with the development of an electronic health knowledgebase. The National electronic Library for Health, now the National Library for Health (http://www.library.nhs.uk/Default.aspx?ref=at) links to all the resources doctors require to practice medicine and contains "accurate information on the latest medical advances and accredited best practice guidance" (Madge, 2001, p.5).

There is so much information available that poor searching (due to a lack of skills) or navigating difficulties will hinder the retrieval of the required evidence (Bennett et al., 2004). Information professionals have recognised that converting the clinical question to a searchable strategy for an information resource is a crucial skill, but difficult to master in practice (Osheroff & Bankowitz, 1993). There are numerous issues that can occur when formulating search strategies: inappropriate search terms; wrong or inappropriate databases; misspelled search terms; inappropriate connectors; and brand drug name rather than generic (Abate et al., 1989). A study of the TRIP database use found just 12% of searches used a Boolean operator (Meats et al., 2007). A study of resident doctors found that question formulation did not improve as they progressed in their clinical training

(Bergus & Emerson, 2005). This lack of skill is compounded when the doctors believe the search failed due to a lack of relevant evidence rather than realising the problem was the errors in their search strategy (Sanders & Del Mer, 2005).

A lack of training was the most common barrier to using the Internet (74%) and databases (62%) according to a UK study (Doney, Barlow & West, 2005).

A teaching intervention in one study did not reduce the perceived barrier of the search strategy not working. Forty-six percent of the control group felt this was a barrier, but of the group that had received the training intervention, 56% still felt this was a barrier to searching Medline (Cabell et al., 2001). This suggests that poor IT searching skills that are not addressed by traditional didactic continuing medical education sessions.

2.2.4.4 Organisational Barriers

This section refers to the structures and systems that are not in place to facilitate the practice of EBM.

One of the major barriers when searching the primary literature sources such as Medline is that the questions generated by medical doctors rarely match those answered by health researchers (Booth, 2001). Medline indexed articles usually just report the results of studies, rather than focus on how this impacts on patient care.

General practitioners may find that the demands of their practices prevent them from searching for evidence (Shelstad, 1996).

Another organisational issue is poorly organised or indexed information in the workplace (Wood et al., 1995). This means that information may be searched for by more than one individual, duplicating effort and wasting time.

2.2.4.5 *Economic Barriers*

Financial issues are a consideration. Full text retrieval can be expensive, especially if the doctor has to request Inter Library Loans (ILLs) (McKibbon & Walker-Dilks, 1995). Limited hospital budgets may result in a restriction on the number of ILLs a doctor can request (Shelstad, 1996). The cost of searching was identified as a major issue by a study in the 1980s, but that was prior to the introduction of free access searching via Pub Med (Covell, Uman & Manning, 1985).

2.2.4.6 *Environmental Barriers*

The location of the doctor may also be an issue. Doctors in rural environments are often isolated from medical schools, research institutions and health libraries (Shelstad, 1996). This may limit their continuing medical education opportunities. Physical access has been identified as a barrier (Buckland, 1988). However, with computer access that is not such a factor now, once the doctor has been taught how to access and search the relevant resources.

2.2.4.7 *Personal or Self-Imposed Barriers*

A lack of training or issues with the technology is often raised by doctors. However in a study by D'Alessandro et al. (1998) on accessing the digital health sciences library, only 34% of the participants had taken up the opportunity for on-site training. A review of the effectiveness of training health professional in literature searching electronic databases found no clear evidence on the effect of teaching qualified doctors (Garg & Turtle, 2003). A study of end-users found that whilst education was important, practice was the biggest reason behind improvement in the quality of searching (McKibbon & Walker-Dilks, 1995). Conversely, literature searching skills decline if not used regularly (Davidoff & Florance, 2000).

Motivation is a key personal barrier. A study by Erickson & Warner (1998) indicated that 60% of the residents questioned would be interested in improving their Medline skills, but none had taken advantage of existing programmes offered by the library staff. This may in part be due to a lack of knowledge of the courses, but also suggests there was a lack of motivation to find out about the sessions, let alone attend one. It is much simpler and easier to draw upon a colleagues' medical knowledge. This type of information gathering also has a social interaction that is lacking with online evidence searching. Forgetfulness was an issue mentioned by one study (Green, Ciampi & Ellis, 2000). Questions that are pursuable are put to one side because of time or work pressures, but then never followed up, as they are forgotten.

Osheroff & Bankowitz (1993) identified problems with retrieving incomplete information and the failure to locate any useful information. These issues may discourage doctors from searching for evidence again. Ely et al. (2005) found that the two key reasons why doctors failed to pursue answers was the doubt that an answer existed (25%) and referring a patient rather than undertaking a literature search (22%).

Table 2.4 compares the various barriers to literature searching categorised in research studies between 1998 and 2005. All but one of the studies identified issues with a "lack of time". Two thirds of the studies mentioned "online resources" or "IT" in general and over half "limited search skills". Cost was identified as an issue in one study (Andrews et al., 2005).

Table 2.4: Barriers to Literature Searching

Study	Lack of time	Irrelevant material	Issues with IT or online resources	Limited search skills	Cost	Forgot the question	Lack of interest or urgency	Answer did not exist or would not affect care
Lewis, Urquhart & Rolinson, 1998	61%			32%				
McColl et al., 1998	71%	4%	6%					
Scott, Heyworth & Fairweather, 2000	74%	49%	43%	41%				
Green, Ciampi & Ellis, 2000	60%		2%			29%	7%	3%
Andrews et al., 2005	76%		22%	25%	33%			
Ely et al., 2005	19%						15%	25%
Lappa, 2005			74%	80%+				

Despite the acknowledged barriers to searching, there are doctors who prefer to undertake their own searching. In one study, 15% of the doctors felt they experienced no barriers to information (Covell, Uman & Manning, 1985).

2.2.5 Doctors Searching

A study of 4000 end-users for the National Library of Medicine (USA) found that doctors preferred to do their own searching, citing familiarity with the subject (83%), speedier results (82%) and enjoyment (66%). However, for 15% of the respondents it was "needs must", because there was no one else to do the searching (McKibbon & Walker-Dilks, 1995).

Medical professionals can be "occasional users" of electronic databases and thus maintaining their skills in literature searching may be problematic. These specialised skills deteriorate rapidly if they are not used regularly (Nowacek & Hodge, 1986). A critical mass of searches is required to maintain searcher competence. Most interviewed librarians agreed that five to ten searches per month were necessary to maintain search skills for each database (Firschein, Summit & Mick, 1981). A survey of Australian general practitioners found they used an online evidence system on average 8.7 searches per month (Magrabi et al., 2005). An American study of primary care doctors found that 44% undertook electronic literature searches a few times a month and 18% at least a few times a week (Andrews et al., 2005). Research of CIAP (Clinical Information Access Program) in Australia found that 60% of users sought evidence more than twice a month and 30% at least once a week (Westbrook, Gosling & Coiera, 2004). In a survey of general practitioners, 97% had used an information source to find the latest evidence and 45% expected to do so a minimum of once a fortnight (Tovey & Godlee, 2004). Therefore, it would seem to be possible for doctors to maintain their information skills at a reasonable level.

If information specialists are available then medical professionals may be more likely to utilise their skills. In one study of an A&E Department, 86% of doctors would prefer to use the skills of a clinical librarian, rather than search themselves (Lappa, 2005).

An early survey of Medline searches found that 48% of the issues raised concerned the search formulation (Walker et al., 1991). A later survey identified the Medline search strategies that end-users utilised, namely keywords (94%), applying "limits" (46%), combining terms with "AND" (39%), using the "related articles" option (38%) and utilising MeSH (Medical Subject Headings) 11% of the time (Cullen, 2002). Decentralising Medline increased the number of searches and the doctor's knowledge of the database (Darmoni et al., 2000). The doctors' responses to a question on their knowledge of concepts showed awareness by 54% for "explosion", "focus" 54% and "MeSH" 46%.

Precision and recall are two methods of measuring the efficiency of the literature search (Jones, 1992). These concepts can be expressed mathematically as (Walker & Janes, 1999 p263/4):

$$\text{precision} = \frac{\text{\# of relevant documents retrieved}}{\text{\# of documents retrieved}}$$

$$\text{recall} = \frac{\text{\# of relevant documents retrieved}}{\text{\# of relevant documents in database}}$$

A survey of Medline focussed on the recall and precision results (McKibbon et al., 1990). Inexperienced searchers had poor recall and precision. Whilst recall improved with experience, precision remained low. Librarians had better recall and precision than even experienced end-users.

2.2.6 Doctors' Questions

In a sample of questions asked by doctors, 53% were potentially answerable from the evidence (Ely et al., 2002).

A survey by Gorman, Ash & Wykoff (1994) involved librarians judging the frequency that doctors' questions could be answered by Medline. Even if this was not their first choice, the librarians estimated that over 80% of the questions could be answered using that particular database.

Another study focussed on whether clinical questions could be answered by EBM resources (Koonce, Giuse & Todd, 2004). Librarians searched UpToDate, the Cochrane Database of Systematic Reviews and HealthGate Clinical Guidelines to answer both complex and general care management questions. The results did not reflect well on the EBM resources. Only 20% of the complex clinical questions were answered and just under half of the general care management using the EBM resources. No answers were found for 40% of the complex clinical questions and 30% of the general care management. However, the primary literature answered 95% of the complex clinical questions and 85% of the general care management.

The rate of pursuing clinical questions was found to be low in most studies. Questions were pursued 29% (Green, Ciampi & Ellis, 2000), 36% (Ely et al., 1999), 30% (Gorman & Helfand, 1995) and 30% (Covell, Uman & Manning, 1985) of the time. The Covell, Uman & Manning (1985) figure only actually applies to questions pursued at the time of the consultation. The excess of unanswered questions reported may be due to the studies themselves stimulating the doctors to ask questions. Other studies reported more questions being pursued; 95% were pursued in an early 1990s study (Ely et al., 1992) and 82% in a later study (Barrie & Ward, 1997). These unanswered questions are missed educational opportunities and suggest the time and money spent on biomedical research is not being exploited effectively.

2.2.7 Time Spent Information Searching

It is difficult to estimate the time that an information search will take. However searching for information twenty years ago involved trawling through Index Medicus and / or browsing the journal shelves looking for that elusive article (Moyer & Elliott, 2001). Since the advent of electronic databases, the time spent searching for the evidence has declined dramatically. Three factors affect the time required to locate evidence (Wish, Collins & Jacobson, 1987):

- The expertise and skill level of the searcher;
- The speed of the Internet connection;
- The suitable preparation of a search strategy combined with the identification of relevant information resources. This also involves translating the clinical questions into terms that the information system can process.

In a study by Gorman, Ash & Wykoff (1994), experienced health librarians spent an average of 43 minutes per question, searching for and selecting articles. A more recent study using an informaticist took an average of 53 minutes (30 database searching and 23 obtaining / appraising full-text articles) to answer surgery questions (Krahn et al., 2006). Another study had a much lower average; 14.4 minutes spent answering each question (D'Alessandro, Kreiter & Peterson, 2004). The study by Green, Ciampi & Ellis (2000) found a similar time for searching with a mean of 15 minutes. McKibbon & Fridsma (2006) found primary care doctors spent a mean of 13 minutes answering two questions, so approximately 6 minutes 30 seconds per question. In a survey of residents, 66% of the searches took only two minutes, whilst the maximum for a search was 15 minutes (Ramos, Linscheid & Schafer, 2003). This type of information searching is really only practical "after hours" and not in the clinical setting (Hersh et al., 2002).

A study by Schilling et al. (2005) broke down the time spent searching into ten-minute segments. Most searches took between 11 and 20 minutes (44%), followed by 21 to 30 minutes (20%) and then under 10 minutes and 31 to 40 minutes (both 13%). A later study by McCord et al. (2007) also broke down the time the doctors spent searching to 48% taking less than a minute, 24% one to two minutes, 17% two to five and 11% more than five minutes.

A study of resources used at the point of care found the median search time was lower, at between 5 and 10 minutes (Schwartz et al., 2003). The research utilising an "evidence cart" found that resources had to be accessible in between 10.2 and

25.4 seconds for them to be practical at the bedside (Sackett & Straus, 1998). This is not surprising as this would be searching in an extremely time-pressurised and "professionally-exposed" environment.

Wyatt & Sullivan (2005, p.1129) prioritised clinical questions:

1. Answers needed immediately;
2. Answers needed before the patient is seen again;
3. Answers needed for other patients or to consider changing clinical practice;
4. Answers are of interest, but will not have a clinical impact.

This prioritisation may explain why answers are required within different time frames. Whilst the patient was in the room, 88% of questions were answered in one study (Ely, Burch & Vinson, 1992). In another study in the early 1990s, doctors required an answer within a few hours 49% of the time and within the day, 55% of the time (Osheroff et al., 1991). A study by Gorman & Helfand (1995) found that of the questions pursued, 48% of questions were answered before the patient left the office, 78% within 24 hours and 84% within 48 hours. A study by Barrie & Ward (1997) found that 61% of the questions were answered during the consultation. Sackett & Straus (1998) found that 90% of the searches on patient management were successful in finding the information in the time available on rounds. In another study, of the questions pursued, 25% were on the same day that the question was asked (Green, Ciampi & Ellis, 2000). A 2003 study found that answers were sought to 74% of the questions immediately, finding satisfactory answers to 87% of them. Residents felt a further 16% of the questions were important enough to be pursued later (Faculty members believed 41% worth following up), but in reality, only 6% were followed up (Ramos, Linscheid & Schafer, 2003).

The success of the searches is important as this really determines if time and effort has been wasted. Residents managed to answer 89% of their questions in a study by Schilling et al. (2005) and GPs 87% of the time in a study by Van Duppen (2007). Ely et al.'s (1999) study found that doctors answered over 90% of the questions they pursued and Gorman & Helfand (1995) reported answers found for 80%. A more recent survey by Ely et al. (2005) found that only 55% of questions were pursued and, of those, 72% were actually answered. In another survey, 73%

of the patient-care problems were solved (Cheng, 2004). However, an earlier study found that after a literature search, 34% of the information was not considered helpful, 25% only partially answered the question and 9% was unreliable (Covell, Uman & Manning, 1985). This means 68% of the information located was not adequate enough to answer the question effectively.

One study considered the efficiency of the searches. These were regarded as very good or good 18% of the time, fair 52% and poor 30% of the time (Scott, Heyworth & Fairweather, 2000).

An issue that doctors may not be aware of is their tendency to focus searches within their specialism (Farmer & Guillaumin, 1979). In one study, 69% of questions asked by sub-specialists were actually on problems outside their specialism (Covell, Uman & Manning, 1985).

Hersh & Hickman (1998) reviewed articles on electronic informant retrieval systems. Their research concluded that most searches retrieved between a quarter to half the relevant articles. An issue of concern is when information is not located, it is then assumed not to exist, whereas in fact it does, but had not been found in that search (Lindberg et al., 1993). The end-user can also be left with a mistaken view of the contents and coverage of the database (DiMartino & Zoe, 1996).

2.2.8 The Cost of Searching

An issue linking the time spent searching and the results retrieved is the cost element. The cost benefit of information searching should be evaluated by comparing the information required and the evidence actually retrieved (Williams, Baker & Marshall, 1992). This would determine the cost effectiveness of a particular search.

Is it a useful and efficient utilisation of resources for highly qualified medical professionals to be searching for evidence? Is it more efficient in time (lost to direct patient care) and money (salary of a doctor compared to a librarian) for an information professional to locate the evidence for the medical professional? Whilst some medical professionals might find it interesting and enjoyable to search for information in biomedical databases, busy doctors really just want the evidence "so that they can to do something else with it", namely treat patients (White, 2000, p.141). Holtum (1999) suggests that librarians have downplayed their skills and not highlighted the complexity of literature searching, giving health professionals a false perception of their skill levels.

2.3 Information Sources Utilised by Doctors

2.3.1 Background

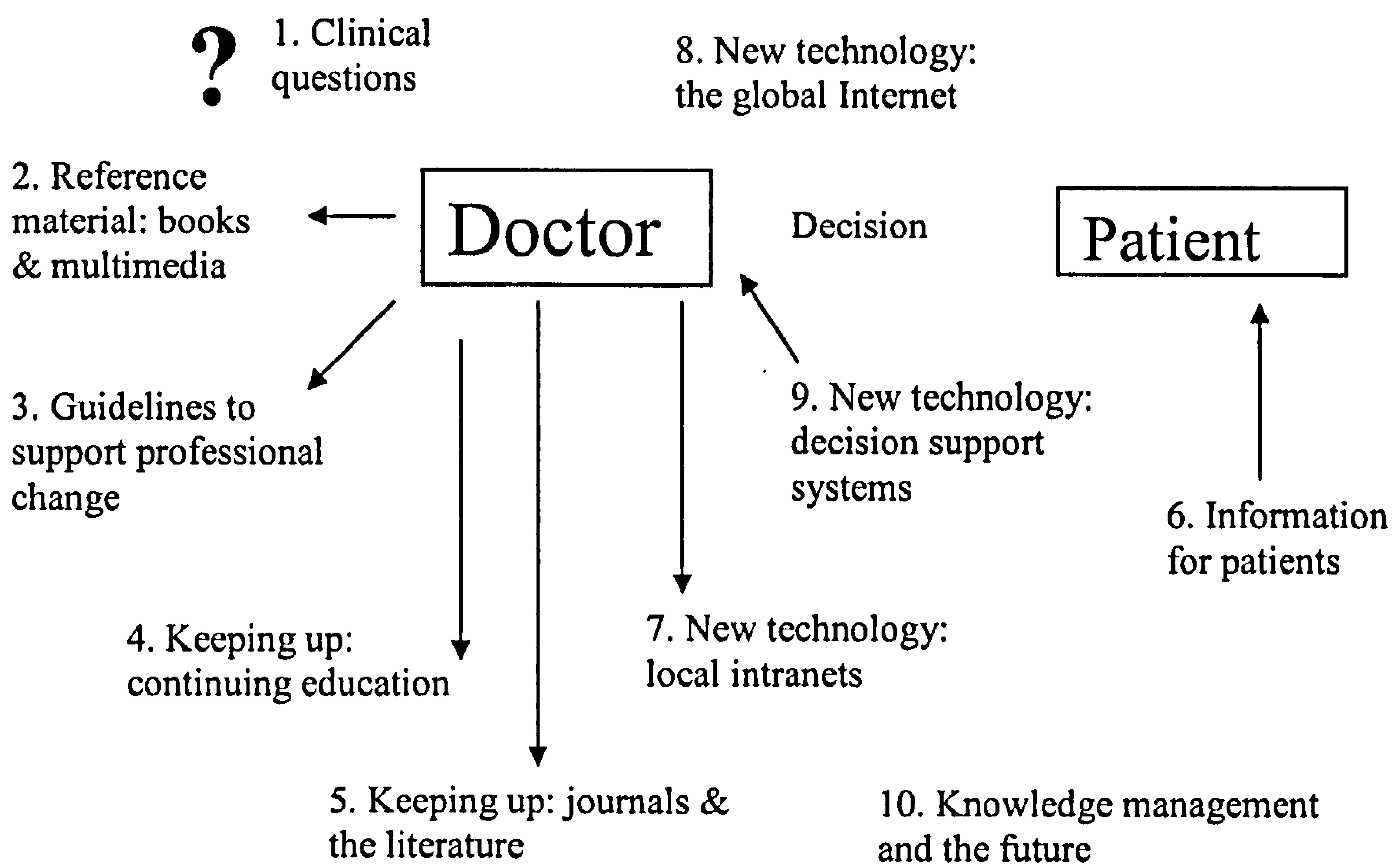
There are a vast range of resources that can be utilised by doctors. In fact, there are almost too many information sources for doctors to locate information efficiently. MacDougall & Brittain (1992, p.7) identified specific information sources suitable for doctors:

- Journal articles;
- Abstracting and indexing tools, such as Index Medicus;
- Government reports and papers from various Departments (such as Health and Environment);
- Online information databases such as Medline and PubMed;
- Reference books and textbooks;
- NHS circulars, statistical data, needs assessment reports, strategy documents and other grey literature (that is, information published in an unconventional manner);

- Drug information, including dosage and compatibility with other pharmaceuticals prescribed.

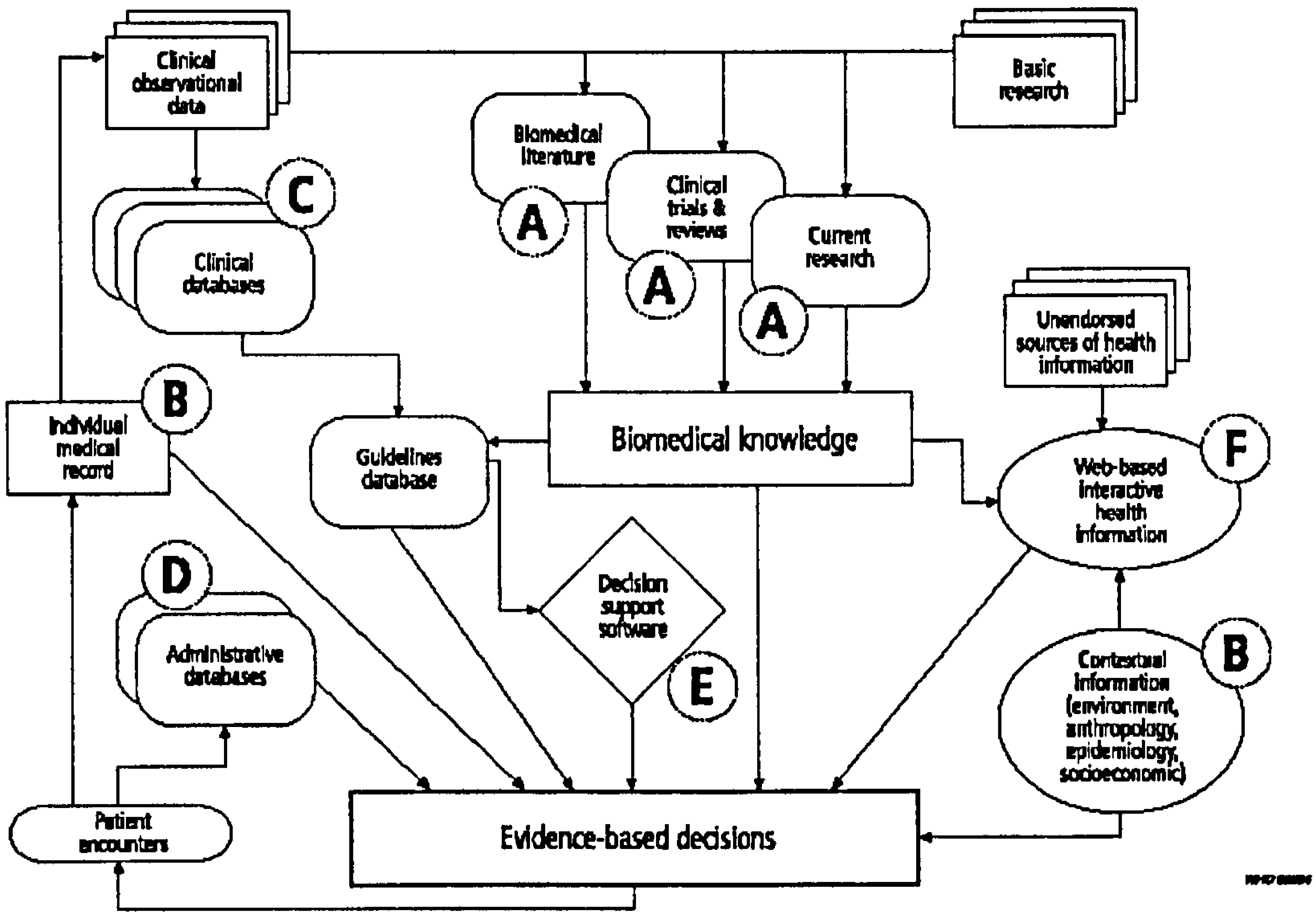
These resources can be described as forming the "structure of knowledge for the clinician", illustrated in Figure 2.9 (Wyatt, 2000, p.169).

Figure 2.9: Structure of Knowledge for the Clinician (Wyatt, 2000, p.169)



Rodrigues (2000) proposed that knowledge is information or evidence "in context" (p.1345). Medical knowledge consists of a wide range of information sources such as original research, systematic reviews, journal articles, textbooks, people (colleagues, consultants, experts, pharmacists, and drug representatives) and electronic resources. Figure 2.10 illustrates the wide range of resources available to doctors (Rodrigues, 2000, p.1346).

Figure 2.10: Range of Applications Supporting EBM (Rodrigues, 2000, p.1346)



KEY			
A	Reference Databases	D	Administrative Data Repositories
B	Contextual and Case-Specific Information	E	Decision Support Software
C	Clinical Data Repositories	F	Internet-based Interactive Health Information

2.3.2 Information Source Use

One study determined that 86% of questions were answered using one source, 6% used two and 5% required three sources (Gorman & Helfand, 1995). A study by D'Alessandro, Kreiter & Peterson (2004) found that on average 1.2 resources were utilised to answer one question. Later studies found an average of 1.8 resources (McKibbon & Fridsma, 2006) and two databases (Van Duppen, 2007) were consulted. Suarez-Almazor et al. (2000) searched for controlled clinical trials for specific topics in Embase and Medline. Two–thirds of the relevant papers retrieved were in both databases and one-third were only in one of the databases. If time permits and users are able to access databases freely via NHSnet (or the Internet with Athens authentication) then really more than one database should be searched to ensure effective coverage of the literature. Potter & Rotert (2005) suggest that end-users choose one or two electronic resources and take the time to learn how to search them quickly and effectively. Doctors can also be taught a "fixed pattern" and sequence of searching to improve the efficiency of their searching (Van Duppen et al., 2007).

There are two main reasons why a question is pursued, especially beyond one information source. The first is the doctor considers the patient's problem to be urgent. The second is the doctor's belief that an answer exists and the evidence can be located to assist the clinical decision (Thompson, 1997).

Gruppen (1990) identified three factors that influenced the resource selection of doctors. The first was the characteristics of the individual doctor, such as age, experience and specialism. Younger doctors tended to utilise the medical literature more than their older counterparts. The second factor is the work characteristics, such as the setting and population size. Doctors in "institutional" settings (hospitals with medical schools) used colleagues more often than those in solo or group practices. Finally the availability of specialists and opinion leaders affected resource selection.

2.3.3 Information Sources Utilised

Table 2.5 compares the information sources utilised by doctors in percentages. Only responses that are comparable to other studies have been included.

Table 2.5: Information Sources Utilised by Doctors

Study	Country	Textbooks	Journal Articles	Humans	Computer Search	Drug Sources
Covell, Uman & Manning, 1985 (Reported)	USA	24%	18%	32%		15%
Covell, Uman & Manning, 1985 (Observed)	USA	3%	7%	53%		11%
Ely, Burch & Vinson, 1992	USA	12%	2%	29%		27%
Lundeen, Tenopir & Wermager, 1994	USA	7%	51%	21%		
Gorman & Helfand, 1995	USA	28%		39%	2%	20%
Barrie & Ward, 1997 (Reported)	Australia	56%	4%	40%	1%	
McAlister et al., 1999	Canada	45%	73%	61%		
Ely et al., 1999	USA	36%[8]		36%	2%	25%
Cogdill et al., 2000	USA	69%		27%	Negligible	
Fozi et al., 2000	Malaysia	29%	16%	16%	23%	
Green, Ciampi et Ellis, 2000	USA	31%	30%[9]	25%		5%

[8] Includes all printed information – textbooks, journals and information on posters

Study	Country	Textbooks	Journal Articles	Humans	Computer Search	Drug Sources
Ramos, Linscheid & Schafer, 2003, Resident	USA	50%		49%		
Ramos, Linscheid & Schafer, 2003, Faculty	USA	70%		24%		
D'Alessandro, Kreiter & Peterson, 2004 - Control	USA	48%	2%	27%	15%	
D'Alessandro, Kreiter & Peterson, 2004 - Intervention	USA	35%	1%	30%	21%	
Ely et al., 2005	USA	37%	6%	18%	16%[10]	
Schilling et al., 2005	USA	5%	33%	1%	53%	1%

[9] Includes original articles 21% and review articles 9%
[10] 12% computer and 4% handheld computer

The two information sources used most frequently (averaged from the studies specified) are text books, 34.4%, followed by "humans", 31.1%. Computers were used on average by 16.6%, but the highest percentage use occurred in the latest published research (Schilling et al., 2005). This may be the start of an increased usage in IT as access with usability issues being addressed.

The heading of "humans" covers all those a doctor is likely to contact. In the Gorman & Helfand study (1995), this included doctors in another speciality (17%), colleagues (13%) and non-doctors, such as pharmacists (9%). The Green, Ciampi & Ellis (2000) study participants consulted with attending doctors (17%), fellow residents (5%) and speciality consultants (3%).

In the Ely, Burch & Vinson (1992) study, just 13% of the family doctors had access to personal computers in their offices so their lack of computer usage could be anticipated. By the 1999 Ely et al. study (using data from 1996 to 1997) 2% actually used computers. This figure had risen to 16% by the Ely et al. study published in 2005.

Four studies did show substantial computer usage. In the Schilling et al. (2005) study, the electronic sources utilised were Medline (73%), UpToDate (70%), MDConsult (6%) and Cochrane Library (3%). The Cullen (2002) study found doctors accessed Medline (70%), clinical guidelines websites (47%) and Cochrane (38%). Another study by Scott, Heyworth & Fairweather (2000) found the evidence source used most frequently was Medline (76%), followed by Cochrane Library (17%), journal articles (14%), textbooks (10%) and then Best Evidence (7%). An American study by Perley et al. (2007) found acute-sector doctors used Medline / PubMed (81%), UpToDate (55%) and the Cochrane Database of Systematic Reviews (25%).

One study compared the use of five portable electronic information products. Interaction features such as the screen layout affected users resulting in them preferring a particular product, UpToDate. This product also found the answers to more of the questions, but whether that was due to the users preferring this product for searching was not considered (Campbell & Ash, 2006).

A 2007 study, by Poolman et al. surveyed members of the Dutch Orthopaedic Association and found just 16.3% were unaware of the Cochrane Database of Systematic Reviews.

A study of the information needs of doctors in the UK found that the most frequently used database by doctors was Medline (Pyne et al., 1999).

2.3.4 Ranking of Information Sources Utilised by Doctors

In a recent study undertaken in Singapore in 2004, doctors preferred to use traditional resources such as textbooks and notes, rating these to be the most useful (Phua & Lim, 2007).

Table 2.6 ranks the information sources utilised by doctors in order of their importance. Exact figures or percentages were not specified in the research articles, so ranking has been utilised.

Table 2.6: Rankings of Information Sources Utilised by Doctors

Study	Country	Text Sources	CATs[11]	Human	CME[12]	Personal Library[13]	Electronic Resources	Internet
Bowden, Kromer & Tobia, 1994	USA			2nd		1st		
Sackett & Straus, 1998	UK	1st		2nd			3rd	
Arroll et al., 2002	New Zealand	1st		2nd			3rd	
Cullen, 2002	New Zealand	1st		2nd		3rd		4th
Bryant, 2004	UK			3rd		1st	2nd	
Oliveri, Gluud & Willie-Jørgensen, 2004	Denmark	1st		2nd			3rd	3rd
Bennett et al., 2005	USA	1st			2nd			3rd
Kim, Bartlett & Lehmann, 2005	USA	2nd		1st			3rd	3rd
McCord et al., 2007	USA	3rd		2nd			1st	1st

[11] CATs – Critically Appraised Topics
[12] CME – Continuing Medical Education
[13] Includes books and journals

Disappointingly, over half the studies ranked text sources first. These are not the optimal EBM sources due to the likelihood that they are possibly not up-to-date (Smith, 1996). CATs are a more evidence-based option, but are only the appraisal of one article. If this is not the most suitable article available on that particular subject then the value of that CAT is minimal.

In over half the studies, the category of "human" was the second choice. The ease of use and interaction with others means these are ideal social and informal methods for gaining information. Unfortunately, these responses may not be based on any reliable evidence. This information is more likely to be someone's opinion, which is actually ranked at the bottom of the evidence hierarchy.

The latest study by McCord et al. (2007) ranked the Internet and associated electronic resources first. This may be an isolated, unique finding or the indication of a change in resource selection by doctors.

The resources used in the Sackett & Straus (1998) study were pre-selected for the participants. From those available the medical students and doctors used Redbook (summaries of peer-reviewed critically appraised evidence) 40% of the time, CATs (Critically Appraised Topics) 21%, Medline 17% and Best Evidence 9%. Medline and the Cochrane Library were used as the last resort.

In a study, doctors were asked to rank resources in order of importance (Tsafrir & Grinberg, 1998, p.42). Contrary to most studies, the librarian and library (61%) and Internet/electronic databases (54%) were deemed more important than colleagues / experts, "in-house" / "outside" (42%) and private collections (35%). The only other study that highlighted the usefulness of electronic resources was the Giuse et al. (1994) study. However, two of the authors were trained information scientists, rather than practicing doctors. Paper sources were consulted first, but 87% of the more easily answerable questions could be answered through electronic resources.

2.3.5 Utilisation of Different Resources by Doctors

Ramos, Linscheid & Schafer (2003) discovered that residents were more likely to consult another person (usually an attending or specialty consultant) to answer their questions. The faculty were more likely to consult texts. The primary literature was used by both residents and faculty less than 1% of the time, which is negligible. These results are similar to the study by Arroll et al. (2002) since the doctors' sources for most answers were books, followed by colleagues. Only 5% of questions were answered using a computer, and most of these were simple not complex questions. In a study of family practitioners by Andrews et al. (2005), print and interpersonal resources were more likely to be used than online sources. Printed drug resources were used several times a week or daily by 61% of respondents and medical textbooks by 58%.

In a British study of general practitioners 90% of their questions were answered by human sources or "Desk Top" reference materials (Barrie & Ward, 1997). Textbooks and journals were rarely utilised. When asked if they would like a resource they currently did not have, 41% mentioned a computer, but most did not seem sure how it might be useful (Barrie & Ward, 1997). McColl et al. (1998) illustrated this lack of awareness of the computer's application for information searching. The Cochrane Database of Systematic Reviews was recognised by 40% of the general practitioners, but only 4% had used the resource to help in clinical decision making. In another survey in Australia 22% of the general practitioners were aware of Cochrane, but just 6% had access to it and only 4% had actually used it (Young & Ward, 1999). In a survey by Ramos, Linscheid & Schafer (2003), EBM resources such as original research, POEMs (Patient-Oriented Evidence that Matters), Clinical Evidence and the Cochrane Library were rarely used by the residents or faculty members.

In London a study was undertaken to determine the use of the Cochrane Library by GPs (Ram & Wellington, 2002). Only 33% of the GPs had used the Cochrane Library and most (85%) of these had only used it occasionally. A disappointing 52% had never heard of the Cochrane Library.

In a British study, UK resources were preferred to American. The BNF was on the PDAs (Personal Digital Assistants) in Phase II and was used by more users compared to the American drug information source used in Phase I (Honeybourne, Sutton & Ward, 2006).

A study by Schilling et al. (2005) taught doctors how to search the medical literature using the electronic medical databases and highlighted useful resources. These databases were bookmarked on their computers for easy access. However, certain resources such as Clinical Evidence were rarely used. Despite the increased availability of EBM resources, Andrews et al. (2005) also found that few practitioners used them.

Consulting with a colleague ranks highly in most of the studies. Doctors often find it quicker to ask a colleague for advice (McKibbon, 1998). A study of communications in a Bristol hospital found the success rate of call events (telephone and paging) was 74% (Coiera & Tombs, 1998). However, a quarter of all call events were actually attempts to identify the name of an individual with a specific role. Medical colleagues accounted for 42% of the calls medical staff received.

In an experiment using an "evidence cart", Sackett & Straus (1998) found the resources most frequently utilised were those fastest to access. Medline was the only resource that was not considered easy to use, with 27% of the doctors experiencing difficulties. The experiment discovered that house staff liked having access to high-quality evidence, but were more concerned with being able to access the information within thirty seconds (Sackett & Straus, 1998). The downside with the evidence cart was its bulk, but new technologies such as PDAs and smart phones (mobile phone / PDA hybrids) are more user-friendly in the clinical setting as they are small and portable, that is, hand-held (León et al., 2007). There are barriers to handhelds which include their reliability, size, security, limited memory and battery life (McAlearney, Schweikhart & Medow, 2004). However, a study in a clinical setting in the UK found that hand-held technology is an effective tool to aid Evidence Based Medicine. These devices can hold sufficient information to be relevant, accessible and effective at the point of care (Honeybourne, Sutton & Ward, 2006; Rothschild et al., 2006). A randomised controlled trial (RCT) showed that students who used the handheld reported that they were more likely to willingly adopt EBM techniques in future clinical practice (Leung et al., 2003).

Dawes & Sampson (2003) identified the key reasons for using particular resources as the convenience of access, routine, trustworthiness, speed of use, suitability and applicability.

A study of British general practitioners highlighted their preference for referring to paper publications rather than the electronic version of that resource (Wilson, Glanville & Watt, 2003). The resources utilised most often were the BMJ (93%), Drug and Therapeutics Bulletin (92%), NICE guidance (82%), Bandolier (69%) and Clinical Evidence (65%).

Journals seem an ideal way for doctors to keep up-to-date and access clinically relevant information. However, the amount of articles generated per year means that it is unlikely that doctors will actually be able to keep abreast of new developments. In one study, the journals used by five primary care journal review services were analysed (Alper et al., 2004). Three hundred and forty-one journals were used by these review services, reviewing an average of 7,287 articles per month. To read all these would take 627.5 hours a month (and there are approximately 732 hours in a month). There was little overlap between the review services (and a sixth resource), with just 2% of the journals used by all the services and 69% only on one list. This suggests that just belonging to one journal review service would not cover all new developments. In the light of this research the few journals that doctors subscribe too, are inadequate for keeping up-to-date with new research.

In a study in the USA, the participants (general surgeons), mentioned professional meetings as a useful information source (Shelstad, 1996). Medical meetings were considered useful for general medical information, though not for patient-specific evidence in an earlier study (Dee & Blazek, 1993).

The use of electronic resources is affected by the type of work the doctor undertakes. In one study, 69% of those involved in medical research had used MEDLARS at least once, in comparison to 27% of all respondents (Strasser, 1978). This is not surprising as Medline was created for researchers not doctors (Ebell, 2003). However, research at McMaster University (Canada) has shown that Medline can be feasibly searched from clinical settings with brief training.

A survey of medical staff's awareness of peer-reviewed research evidence produced highly varied results between generalists (family doctors) and specialists, in this case, oncologists (Sigouin & Jadad, 2002). This is illustrated in Table 2.7.

Table 2.7: Awareness and Use of Research Evidence (Sigouin & Jadad, 2002, p2868)

Resources	Family Physicians	Oncologists
Used the Cochrane Collaboration	33%	75%
Used Medline	92%	100%
Used PubMed	20%	64%

A study of general practitioners in the UK found there was limited use of the clinical effectiveness electronic resources (Prescott et al., 1997). The journals (usually sent to GPs as paper publications) from the NHS Centre for Review and Dissemination were used regularly by 21% of respondents compared to 11% using the electronic databases form the same organisation. Table 2.8 highlights the survey findings. It must be noted that the Cochrane Library was not available on CD-ROM or via the Internet at the time of this survey.

Table 2.8: Use and awareness of research evidence – a random sample of non-fundholders (Prescott et al., 1997, p.321)

Resource	Refer regularly	Refer occasionally	Aware – not used	Never heard of
Cochrane Database of Systematic Reviews[14]	3%	7%	21%	69%
Drugs and Therapeutics Bulletin	49%	45%	4%	<1%
NHS Centre for Review and Dissemination databases	2%	9%	18%	71%
NHS Centre for Review and Dissemination journals	8%	13%	13%	66%
Bandolier	2%	5%	7%	86%

A survey of general practice staff in Scotland found that 25% of leads / chairs felt that Bandolier had been "used and has influenced my practice" (O'Donnell, 2004, p.201)

A later survey of UK general practice staff illustrated that some were still unaware of Cochrane (Wilson, Glanville & Watt, 2003). This point is illustrated in Table 2.9.

Table 2.9: Use and Awareness of Resources by General Practice Staff (Wilson, Glanville & Watt, 2003, p.175)

Resource	Used	Never Heard Of
Cochrane Library	38%	11%
NSF – National Service Framework	33%	32%
NeLH –in pilot stage then	21%	32%

Coumou & Meijman (2006) classified the Cochrane Library as "The Expert" since it is a filtered information source. However the outcomes are research focussed and are not related to the specific problems of individual patients.

[14] Now combined with the NHS Centre for Review and Dissemination databases

A postal survey in 2000 of Australian and New Zealand radiation oncologists and registrars determined their awareness and use of electronic resources (Veness, Rikard-Bell & Ward, 2003). Table 2.10 shows the responses for two of the resources. Respondents were more aware of the Cochrane Library. However, the figure for not knowing about DARE was extremely high, especially since this has been part of the Cochrane Collaboration since 1996.

Table 2.10: Use and Awareness of Resources by Radiation Oncologists and Registrars (Veness, Rikard-Bell & Ward, 2003, p.412)

Resource	Used	Aware But Not Used	Unaware
Cochrane Library	20%	52%	18%
DARE	3%	33%	61%

A survey of just the radiation oncologist registrars was repeated in 2003. 94% were aware of the Cochrane Library and 49% had used it (Wong & Veness, 2005). This is a substantial increase since the 2000 data (Veness, Rikard-Bell & Ward, 2003). Awareness of DARE had risen from 19% to 50% and usage from none to 15% (Wong & Veness, 2005, p.124).

In a study in Canada, participants reported using EBM "always" (11%), "often" (59%) and "sometimes" (27%) (McAlister et al., 1999). However, only a minority reported using EBM-related information sources such as clinical practice guidelines (27%) or Cochrane Collaboration Reviews (5%) on a regular basis.

McColl et al. (1998) investigated GPs in the Wessex region of England in 1997. Bandolier at that time was a UK monthly newsletter about evidence-based health care. However 48% of the respondents to this survey were not aware of Bandolier and only 19% had actually read the publication.

Five studies focussed on the use of Medline. Chambliss & Conley (1996) compared the usefulness of Medline and textbooks in answering clinical questions. Unanswered questions were collected from family doctors. Medical librarians were able to answer 54% of them (71% by using Medline, 20% textbooks and 9%

using a combination). However, precluding other information sources does skew the results. The study by Verhoeven, Boerma & Meyboom-de Jong (2000) compared three Medline sources, paper (Index Medicus), CD-ROM and on-line. The simplest method (paper) was the most effectively utilised by the general practitioners, especially for inexperienced searchers. However, in this study the participants had a limited paper version (one year) to search, whereas searching even ten years in this format would be extremely time-consuming. A French study compared the use of centralised Medline (in the library) and decentralised access via the Intranet (Darmoni et al., 2000). There was a sharp increase in Medline use when it was networked. The aim of the searches also changed, becoming more patient-focussed. In another study by Byrnes, Kulick & Schwartz (2004) participants were taught how to use Medline. Table 2.11 illustrates the changes in attitudes and behaviours that occurred during this study.

Table 2.11: Respondents Answers to Specific Questions Over the Life of the Study (Byrnes, Kulick & Schwartz, 2004, p337)

Questions	Pre Intervention	Immediate Post Intervention	Three Months Post Intervention
Sometimes or often searched Medline to assist in clinical decision making	13%	36%	65%
Believed that EBM is important or very important in providing optimum patient care	43%	79%	78%

Bowden, Kromer & Tobia (1994, p.193) reported doctors' reasons for using Medline, as illustrated in Table 2.12.

Table 2.12: Reported Reasons for Using Medline (Bowden, Kromer & Tobia, 1994, p.193)

	Rural	Urban
Patient care (general)	27.9%	43.8%
Confirm an opinion	18.2%	24.1%
Lecture / paper	23.9%	58.6%
Learn about a new field	14.3%	31.5%
Stay current	24.3%	42%
Research	7.5%	21%
Legal or regulatory questions	12.5%	8.6%

A survey of primary care doctors conducted in the USA, in 2000 reported that Medline and PubMed were well-used in the clinical setting (Wheeler, 2007).

Medline is available to search for free on the Internet as PubMed. In 2001 PubMed added a new search option to the Clinical Queries section that limits searches to systematic reviews and evidence-based clinical guidelines (Doig & Simpson, 2003). This limits and focuses the search by study category, namely etiology, diagnosis, therapy, prognosis or clinical prediction guides. Specialist search engines can also limit to systematic reviews or topics in medical genetics. These can all reduce the likelihood of information overload.

A survey of general practitioners found NHSnet was mainly used for research; locating guidance; finding patient information; and retrieving test results from hospitals (Wilson, Glanville & Watt, 2003).

General practitioners in Wales have the option of contacting ATTRACT for answers to specific patient centred questions. In an evaluation study the turnaround was found to be fast (around six hours) and resulted in changes in practice with half the cases. The GPs who responded to a survey found the service "useful" (31%) or "very useful" (69%) (Brassey et al., 2001). NHS staff from outside Wales can access the questions and answers, but not pose questions themselves.

Alper et al. (2001) reviewed electronic medical databases to determine if they were able to answer clinical questions from family doctors. Key databases were excluded from the study such as the Cochrane Library (scope covered not broad enough), Best Evidence (only updated annually), Oxford CATBank, UpToDate, Medline, DARE, Prodigy and PubMed Clinical Queries. Various combinations of databases answered over 75% of the questions. Despite the range of electronic resources available, no existing resource is comprehensive enough to satisfactorily answer all clinical questions. This is a major issue as time constraints mean doctors would prefer to utilise one authoritative source, rather than search several information sources.

The Internet as an information resource for doctors has been evaluated by several studies. In particular, a systematic review of doctors' use of the Internet determined that access to the Internet in developed countries has steadily grown between 1994 and 2004 (Masters, 2008). This study also found that doctors used the Internet more than their national average. A postal survey of British general practitioners found that 82% used the Internet, but fewer (53%) used electronic biomedical databases (Doney, Barlow & West, 2005). A New Zealand study reported that 49% of family practitioners used the Internet for clinical information (Cullen, 2002). The respondents in this study were confused about the difference between search engines and databases. Medline and PubMed were listed as "other search engines" by 6% of respondents. Several medical sites such as the BMJ (British Medical Journal) and Cochrane were also listed as search engines. This confusion raises concerns. Doctors must be aware of the validity and integrity of the websites they access. General web search engines will locate sites that do not provide authentic healthcare information. The doctor should double-check and validate all information from the web, which can be time-consuming and is not always straightforward.

Bennett et al. (2004) identified doctors' reasons for using the internet to seek clinical information:

- accessing the latest research on specific topics – 46.1%;
- accessing new information in a disease area – 44.4%;

- information related to a specific patient problem – 43.7%;
- drug dose information – 40.4%;
- new therapy or product information – 38.1%.

The Internet is a potential useful tool in disseminating biomedical research evidence (Jadad et al., 2000). Government departments, such as the Department of Health and organisations (NICE, Royal Colleges) use the Internet to enable access to full-text documents and guidelines. Electronic databases and other resources are accessible via the National Library for Health (http://www.library.nhs.uk/Default.aspx?ref=at), either available to all for free or to NHS staff via Athens authentication passwords (Georgiou, 2002). However the technology may let the users down due to the "bandwidth" or speed of the connection (Jadad et al., 2000).

A recent controversial article searched Google to answer diagnostic cases published in the New England Journal of Medicine in 2005 (Tang & Ng, 2006). Over half the searches revealed the correct diagnosis, but that does mean that over 40% were not answered using this search engine. Google should really only be seen as a supplemental resource, rather than the first resource utilised.

Doctors based their selection of information source on their perception of the quality of that source and the trust they placed in that source to provide an adequate answer 47% of the time. The next important factor, with 38%, was the accessibility of the source (Covell, Uman & Manning, 1985). In another study the most important criteria was the currency of the information (almost 80%), followed by approximately 70% stating reliability and availability (Tsafrir & Grinberg, 1998). A study in the UK using an "evidence-cart" found that after removal of the resource, the perceived need for information rose, but a search was only carried out 12% of the time, as the information was no longer readily available (Sackett & Straus, 1998). This suggests that whilst quality is a major issue, accessibility and speed of access are also important considerations.

2.4 Evidence Based Medicine

2.4.1 Background

The term "Evidence Based Medicine" first appeared at McMaster Medical School in Canada in the 1980s (Evidence Based Medicine Working Group, 1992). The origins for this concept derive from clinical epidemiology, specifically utilising research from the population level for the care of the individual patient (Sackett et al., 1991). In 1992, the concept of Evidence Based Medicine (EBM) reached the wider medical audience via an article published in the Journal of the American Medical Association, JAMA (Evidence Based Medicine Working Group, 1992).

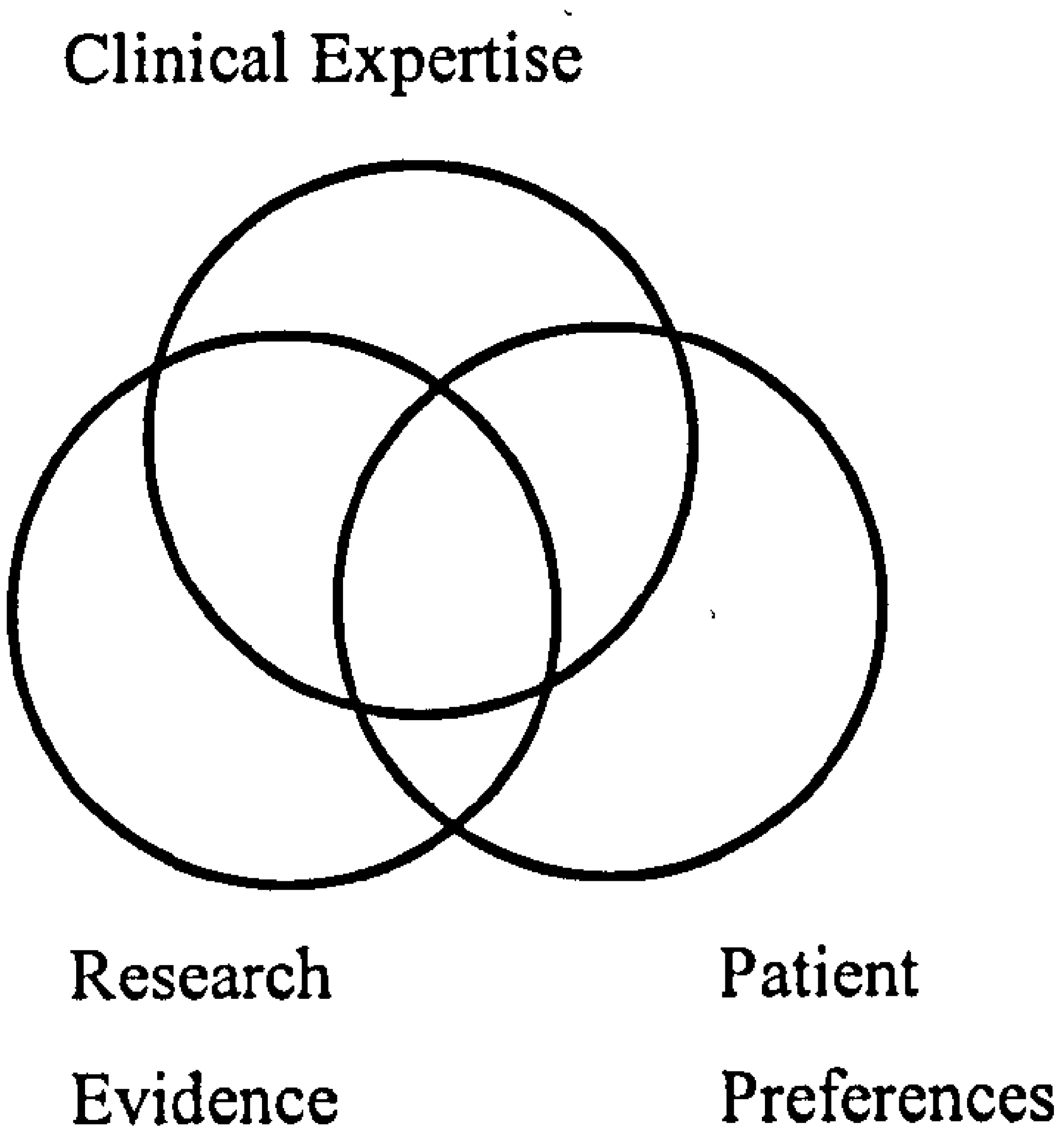
Sackett et al. (1996, p.71) described EBM as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients".

Evidence Based Medicine was the first expression used. There have been many derivatives since, such as Evidence Based Practice and Evidence Based Healthcare. However, this text will refer to the original concept, EBM.

2.4.2 Concept of EBM

Evidence Based Medicine is basically a combination of the best "research evidence" available combined with the "clinical expertise" of the medical professional, taking into account the principles, concerns and values of the "individual patient". The "research evidence" should be clinically relevant. To be considered the "best" research evidence it must be valid, reliable and applicable. The "validity" refers to the evidence being unbiased and "reliability" refers to the trustworthiness of the evidence and "applicability" to the patient scenario being considered (Booth & Brice, 2004). The "clinical expertise" refers to the skills and experience of the doctor. This element is the part that separates EBM from "cookbook medicine" and the automated application of protocols and guidelines (Haynes et al., 1996, p.197). The "individual patient" will have distinctive preferences, values, concerns and outlooks (Akobeng, 2005). No two patients will be the same and this will ultimately affect the treatment option selected by the doctor.

Figure 2.11: A Model for Evidence-Based Clinical Decisions (Haynes et al., 1996, p.196)



In practice, medicine (and EBM) requires "thoughtful doctors who are able to filter the evidence appropriate to each patient through an interpreted and individualised approach" (Sullivan & MacNaughton, 1996, p.943). This is illustrated in Figure 2.11 (Haynes et al., 1996, p.196).

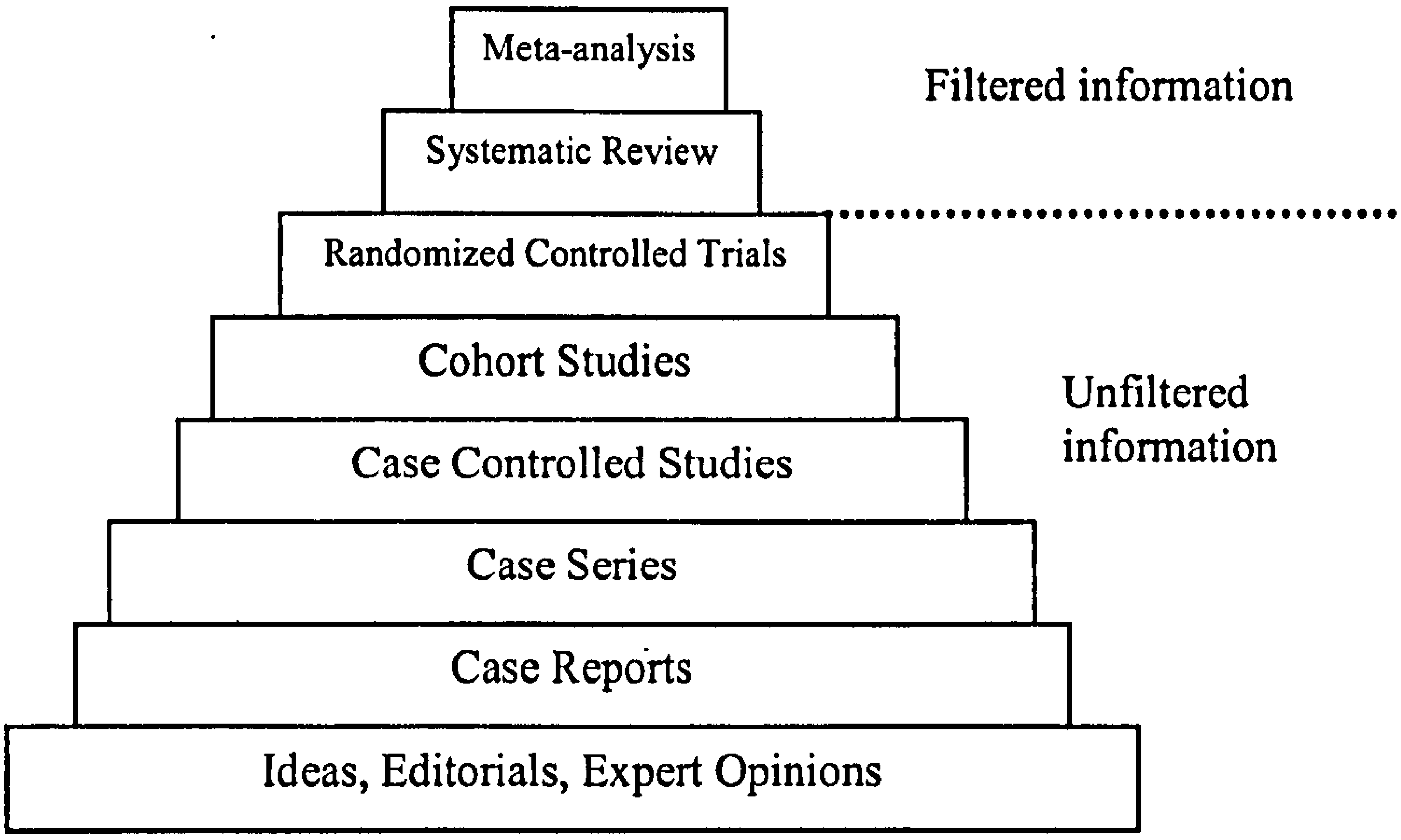
EBM is a valid and worthwhile concept, but it is only a tool to ensure patients receive the most efficient and effective treatment possible. Twenty-five years ago, the concept of "Problem-Oriented Medical Record" or POMR introduced a new way of structuring information. However, advocates spent more time on the record itself than taking care of the actual patient. This should be a warning to supporters of EBM to ensure their focus remains on patient care and does not shift towards the systematic reviews and computer databases (Feinstein & Horwitz, 1997).

In the clinical setting, the minimal requirement for doctors should be a basic understanding of the principles of EBM, the willingness to implement evidence-based policies and to be critical of the evidence and their own clinical practice (Dawes & Sampson, 2005). This would facilitate the practice of EBM, with minimal impact on the doctors' time and workload.

2.4.3 Levels of Evidence

The main principle behind Evidence Based Medicine is the "evidence". The best evidence or "gold standard" is considered to be the Randomised Controlled Trial (RCT). This is because RCTs minimise bias by comparing a treatment to a placebo (the control group). The groups develop from the random assignment of patients, without either the patients or doctors knowing who is in which group. The term given to this procedure is "double-blinding" (Beaven & McHugh, 2003). Various sources are potential suppliers of evidence, including published reports (of research and clinical trials), accounts of practice, patient charts and observations (Earl-Slater, 2001). Consensus or narrative evidence can be utilised if quantitative data is not available (Parker, Del Mer & Glasziou, 2002). The actual sequence or hierarchy of these levels of evidence are illustrated in Figure 2.12, derived from Booth & Brice, 2004 (p.110).

Figure 2.12: The Hierarchy for the Levels of Evidence (Derived from Booth & Brice, 2004, p.110)



2.4.4 Development of EBM

The concept of EBM developed rapidly. The number of articles on evidence based practice has grown from one in 1992 to approximately 1,000 in 1998 (Sackett et al., 2000). A search in Medline for the words "evidence based" on 1st May 2003 returned 53,998 citations, of which 78% were from the last ten years (Alper et al., 2004). On 1st February 2005 a Medline search on the phrase "evidence based" (in quotation marks to form a phrase) produced 26,785 citations, of which 12,693 (47%) were from 2003 onwards. Entering the terms evidence based as keywords, which novice searchers may utilise, produced 79,751 citations, of which 27,510 (34%) were from 2003 onwards. These two searches were also completed on PubMed for comparison, as illustrated in Table 2.13.

Table 2.13: Comparison of PubMed and Medline "Searches

	"evidence based"	evidence based
Medline	26,785	79,751
PubMed	27,252	82,467

2.4.5 Reasons for the Development of EBM

EBM has developed in the UK due to the ongoing disquiet over the variations of "quality of care" at individual, local and regional levels (Bauchner, 1999). This has been referred to in the mass media as the "post code lottery" (Dranove, 2003). Two examples of this issue are the disparities in GP services (BBC Health News, 2002) and the variations in cancer drug treatments (Marsh, 2003).

Malpractice allegations can be minimised by practising Evidence Based Medicine since the medical staff should be able to justify the treatment action taken. Research in the USA has been utilised to determine a national figure for deaths due to medical errors. These figures range from 44,000 to 98,000 American deaths per year (Kohn, Corrigan & Donaldson, 1999). Research in the UK is in its infancy, but the publication, An Organisation with a Memory, suggests that in NHS hospitals adverse events in which harm is caused to patients "occur in around 10% of admissions – or at a rate in excess of 850,000 a year" (Department of Health, 2000, p.viii).

The rise in injury and death of patients from errors in medical treatment or incorrect use of medical devices has resulted in huge claims for compensation in the UK. The compensation awarded by the courts doubled from £1.3 billion (net) in 1996-7 to £2.6 billion in 2001 (Pollock, 2005). That figure was close to five per cent of the total NHS budget for 2001. This led the NHS to focus on Clinical Governance and Risk Management. Clinical Governance necessitates that treatment should be based on reliable and valid evidence (Reid, Ikkos & Hopkins, 2002). In practice this means the right people must receive the right information at the right time (Urquhart, 2000).

2.4.6 The Five Steps of EBM

The first step is to convert the information need into a question that can actually be answered. The second step is to actually track down the best evidence to answer that question. The third step involves the critical appraisal of the evidence for its validity, impact, relevance and applicability. The fourth step implements the results in practice by combining the critically appraised evidence with the clinical expertise of the medical staff for the benefit of the individual patient. The fifth and final step is to evaluate the performance by reviewing the effectiveness of the last four steps to determine if the impact on patient care was positive (Swinglehurst, 2005). In practice the fifth step may be dropped due to time constraints and a lack of opportunity on which to "reflect" on the patient's care once that patient has been discharged.

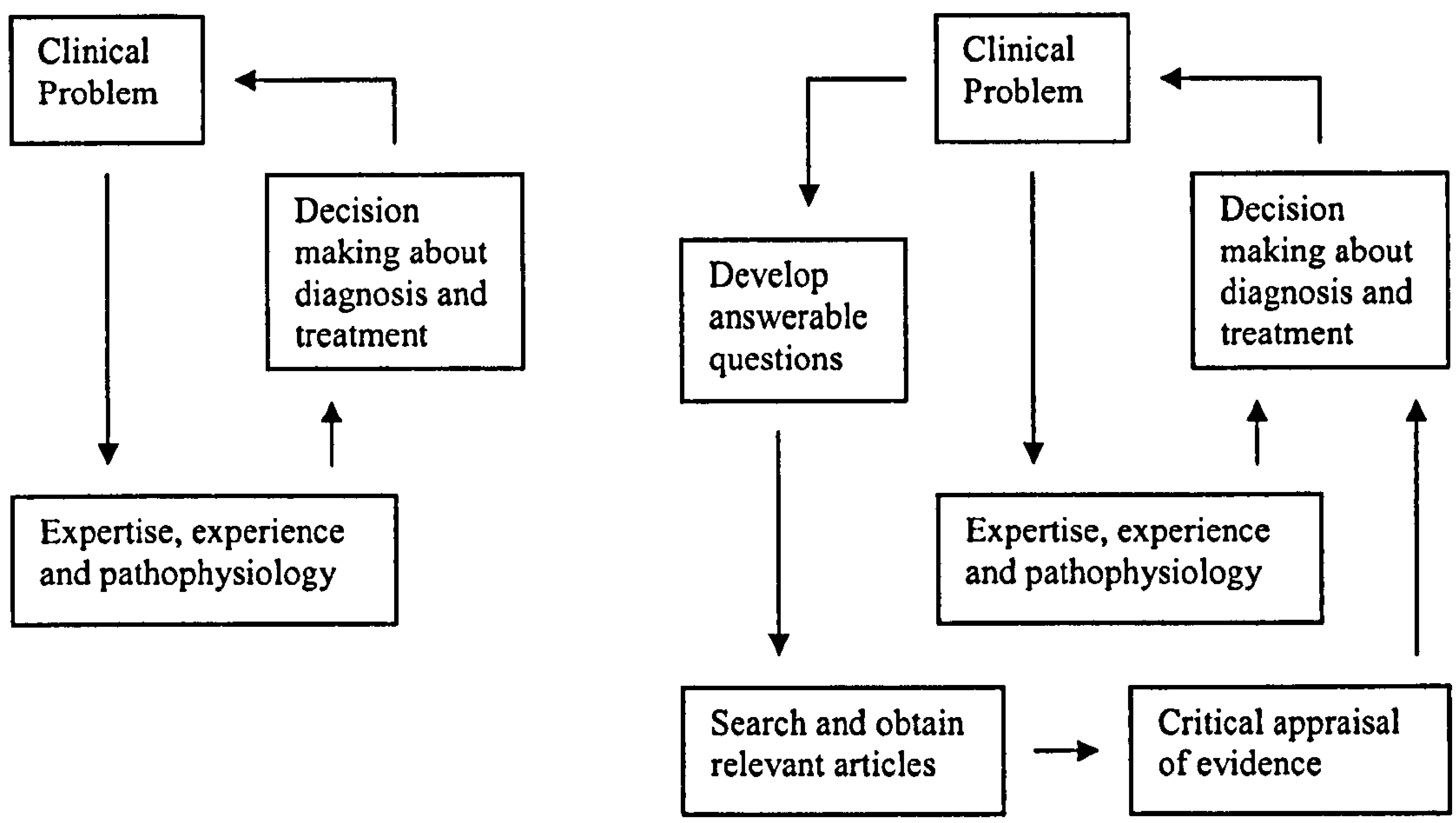
The actual application of Evidence Based Medicine to patients involves comparing the potential benefits and possible harm that the treatment will have on the individual patient. This requires evaluation by creating a "balance sheet" for that particular patient (Craig, Irwig & Stockler, 2001).

There have been suggestions that there are in fact six steps to practising EBM. The additional step occurs after the original step one (formulating a searchable question). This additional step is "answering the question based on "internal evidence" only" (Porzsolt et al., 2003). This is basically the doctor using their acquired knowledge (through education or experience) to add information to the subject prior to finding the "external" evidence. This would reflect situations when doctors know the answer from past experience, but wish to ensure there have been no recent developments or when they wish to confirm that the knowledge they possess is accurate. This step probably occurs intrinsically within the original step one with the previous knowledge of the doctor enabling the search question to be refined and more focussed. Therefore, this sixth step is an interesting footnote, and highlights the doctors' personal skills and knowledge explicitly. However, this is not a step that I feel needs to be heavily promoted.

2.4.7 EBM in Practice

In practice EBM alters the dynamics of the information flow on ward rounds. Figures 2.13a and 2.13b illustrate this difference.

Figure 2.13: Comparison of Traditional and EBM Ward Round (Deshpande et al., 2003, p.87)
Figure 2-13a: Traditional Ward Round **Figure 2-13b: EBM Supported Ward Round**



2.4.8 Terms Associated with EBM

The steps for EBM are relatively straightforward. However, associated with this principle are several new terms, many of which require calculations, such as (Sur et al., 2006; Barratt et al., 2004):

- "Relative Risk Reduction" – the extent to which a treatment reduces a risk, compared to patients not receiving the treatment;
- "Absolute Risk Reduction" – the difference in risk between the control group and the treated group;

- "Systematic Review" – an explicit method for undertaking a complete literature review and critical appraisal. Appropriate statistical techniques combine valid studies to provide a summary of the medical literature.
- "Number Needed to Treat" – the number of patients who need to be treated for one of them to benefit;
- "Confidence Interval" – quantifies the uncertainty in measurement. A 95% confidence interval is the range of values within which we can be 95% sure that the true value for the whole population lies.
- "Publication Bias" – refers to the tendency of researchers, reviewers and editors to submit and accept manuscripts on the direction or strength of the research findings. Positive outcomes are more likely to be published in medical journals than negative.

2.4.9 Barriers to the Practice of EBM

Despite all the potential benefits of EBM there are several issues and concerns associated with its practice. The potential barriers to the practice of EBM are considered to be (Callen, Fennell & McIntosh, 2006; Green & Ruff, 2005; Bhandari et al., 2003; Cranney et al., 2001; Tomlin, Humphrey & Rogers, 1999):

- Organisational - lack of computers, lack of local protocols, staff shortages, and hierarchy;
- Technical - Internet connections and firewalls;
- Structural – workload and the general practice environment;
- Attitudinal - reluctance to embrace EBM, biases and low motivation;
- Personal – lack of interest, fatigue and self-perceived shortcomings (in knowledge and skills);
- Cultural - team dynamics, lack of action, apathy and question of leadership;
- Educational – lack of suitable training opportunities or time "ring-fenced" to attend training;
- Patient – suffering from more than one medical condition, non-compliance, attitudes and expectations;
- Political – government restrictions and funding.

2.4.9.1 Lack of Time

The most frequently cited problem is the lack of personal time to develop the necessary skills and then to locate / appraise the information (Straus & McAlister, 2000). This is a fundamental issue. It takes less "work" to ask an expert, than look for the evidence.

An expert can provide a "human touch", which computerised resources by their very nature cannot. However the "validity" and "relevance" of the expert's opinion may not be sound, especially if it is based on anecdotal evidence (Slawson & Shaughnessy, 1997). If doctors will never have the time to be able to effectively practice all five steps of EBM, it is worth considering whether to waste their time learning all the EBM skills in the first place (Boon, 2005). In a survey by McColl et al. (1998) 95% of the general practitioners in the UK felt they should not be identifying and appraising research evidence or systematic reviews. Guyatt et al. (2000) suggests that not every doctor needs to search and appraise the evidence, but all doctors should at least understand the basic skills involved. Most doctors should have basic EBM knowledge and skills, whilst only those involved in guideline preparation or systematic reviews would need advanced skills. To this end, there has been a recent trend to distinguish between "evidence users" from those "reviewing the original literature" (Guyatt et al., 2000, p.955). The "using" approach restricts the searching to evidence that has already been appraised, so step three (critical appraisal) is ignored (Moyer, 2004).

2.4.9.2 Issue of Relevant Evidence

EBM focuses on the small proportion of the medical knowledge that is relevant for patient care. In a survey by McAlister et al. (1999) 26% felt that the lack of relevant evidence was a barrier to practicing EBM. This lack of relevant evidence will take time to redress, but does not justify ignoring the basic principles of Evidence Based Medicine, namely utilising the "best available" evidence. However the doctor has to sieve through all the irrelevant information to locate the useful. This is a vast amount since there are between 20,000 and 30,000 biomedical journals published annually (Booth, 1996) and the amount of biomedical information doubles every twenty years (Wyatt & Sullivan, 2005). It is understandable why doctors feel it is easier to rely on expert opinions and colleagues, even though these may potentially be biased (Beaven & McHugh, 2003). This means that with regard to EBM, what doctors should do and what they actually do in practice may bear no relation to each other (Davidoff et al., 1995).

The Cochrane Collaboration estimates that it would take thirty years to summarise the current controlled trails into Cochrane reviews. That assumes that nothing new is added or updated during the thirty years, which is completely unrealistic (Alper et al., 2004).

2.4.9.3 Doctors' Skills and Knowledge

If doctors do attempt to locate information, one cited problem is forming suitably constructed questions on which to base the search (Ely et al., 2002). Training should reduce that problem, but in reality question formation improves the most through practice.

Doctors also need to have the computer skills to use a computer and access the electronic medical databases (Rader & Gagnon, 2000). The amount of medical information now available means the only method of effectively searching is to use computers and their processing capabilities.

Another issue in locating the information is where to look for it. Appendix II outlines useful resources for the practice of Evidence Based Medicine. These resources must be available at the point of care for them to be of any practical use (Scott, Heyworth & Fairweather, 2000). However these resources must all be searched individually. There is no database or website that collates all these resources so that only one search is needed. The different funding mechanisms behind these organisations means such a development is unlikely, but this would be an enormous time-saving development.

A concern linked to information searching is to know when to stop looking for the information (Ely et al., 2002). Again, practice develops experience and confidence. In theory, every resource should be searched, but with experience the more suitable resources for specific searches are identified. The down-side is that all this practice does take time, which is already an issue with doctors. Frustration can also occur over the time wasted when a resource does not provide an answer or when the evidence is too weak (or unreliable) to use for patient care decisions (Ely et al., 2002).

2.4.9.4 Critical Appraisal

Critical appraisal takes time and skills to review an article effectively. Critical appraisal enables the doctor to determine if the results found are drawn from a similar medical situation or environment. Some trials have such restrictive requirements that they are rarely applicable to the "real world". Critical appraisal is easier as a group activity so ideas can be bounced off each other than for an individual. Therefore journal clubs are ideal vehicles for developing critical appraisal skills. The Centre for Health Evidence in Canada (http://www.cche.net/usersguides/main.asp) provides simple guidelines for critical appraisal that were originally published as a series in the Journal of the American Medical Association (Centre for Health Evidence, [n.d.]). There are also tools developed by organisations such as Critical Appraisal Skills Programme (CASP) that assist with the actual process of critical appraisal. The CASP website (http://www.phru.nhs.uk/Pages/PHD/resources.htm) contains appraisal tools for systematic reviews, randomised controlled trials, qualitative research studies, economic evaluation studies, cohort studies, case control studies and diagnostic test studies (Public Health Resource Unit, 2007). The final outcome of the critical appraisal must result in an action that affects the patient, either by supporting a treatment or eliminating a treatment (due to its potential harm). Otherwise the whole process has been a waste of time (Sackett & Rosenberg, 1995). A review by Coomarasamy et al. (2001) suggests that one of the weaknesses in critical appraisals was the identification of suitable articles. This points to a weakness in the literature searching and highlights the fact that all the steps must be effectively performed for EBM to be efficiently practiced.

2.4.9.5 Concerns over EBM Terms

Concepts such as the "number needed to treat" assist doctors with the difficult task of applying evidence gained from population studies to the management of individual patients. Research suggests that doctors are not confident with the evidence-based terms. In one study only 15% were able to explain satisfactorily the concept of "publication bias" (McColl et al., 1998). In another survey by Young, Glasziou & Ward (2002) only 14% of general practitioners felt their understanding of the EBM term "levels of evidence" was good enough to explain to others.

2.4.9.6 Concerns with the Levels of Evidence

If only the highest level of evidence is considered then the number of medical decisions made will be restricted (Kerridge & Saul, 2003). However, EBM in practice involves the "best available evidence", so if the highest level is not available, then other levels of evidence should be considered. In some medical areas such as palliative care and psychiatry, randomised controlled trials are not suitable research methods so that level of evidence is unlikely to be generated in those areas (Dickenson & Vineis, 2002).

2.4.9.7 EBM and the Patient

There may be tensions between the practice of EBM and the actual patient themselves. Patients ultimately have the final say in treatment and may, for their own personal reasons, not want the treatment that the evidence suggests is the most suitable (Dickenson & Vineis, 2002). Communication is the key skill required by the doctor. The ability to outline the evidence in lay terms is important so that the patient understands the potential risks as well as the possible benefits. This empowers the patients (Summerskill, 2005). Then the patient can take part in the decision-making process, which is vital to maximise the effectiveness of EBM in practice. However, it is important that the doctor does not allow their values, views or concerns to affect their interpretation of the evidence (Cayley, 2003). Research utilising focus groups with general practitioners in the UK found that issues relating to patients (such as the perception that specialists in secondary care treat the disease rather than the patient) was one of the main reasons why they failed to implement the evidence in practice (Freeman & Sweeney, 2001).

2.4.9.8 Teaching EBM

The teaching of EBM should be delivered in such a manner that it actually affects a doctor's behaviours. Traditional methods such as educational materials and conferences have little direct impact on improving professional practice (Davis et al., 1995). The most effective methods involve interaction, innovation and participation (Bauchner, Simpson & Chessare, 2001). Bero et al. (1998) identified the four most effective interventions as educational outreach visits; reminders; combined interventions; and interactive educational meetings. Doctors need to keep up-to-date and not rely on the information they learnt on their undergraduate course which may have been over forty years ago (Robertson, 1981). Learning does not stop at graduation (Kirby, Liddiard & Moore, 1998). Unfortunately, the traditional instructive method of revising information to regurgitate in examinations does not actually prepare doctors for lifelong learning (Shaughnessy

& Slawson, 1999). EBM requires self-directed lifelong learning, since doctors need to develop new skills in literature searching (as well as update them when databases alter) and critical appraisal (Glanville, Haines & Auston, 1998).

2.4.9.9 EBM Challenges "Experts"

EBM is the complete opposite to the traditional principle of "medicine by authority" (Rodrigues, 2000, p.1344). Then, consultant doctors were considered the "experts" and passed on their knowledge directly to the new doctors and those in training. The commitment to EBM in Japan is declining as the "elder" consultants are not revered to the same extent (Yokota et al., 2005). Haynes (2002) suggests that EBM is now attempting to supplement rather than replace "traditional" medical skills and knowledge.

2.4.9.10 EBM and Costs

Opponents of EBM suggest that it is simply a cost-cutting exercise. This does not seem likely since the cost of producing systematic reviews and guidelines is not low and the conclusions they reach are based on the evidence, not the cost of the treatment (Straus & McAlister, 2000). However when deciding on whether to follow the evidence and implement a particular treatment the doctor has to consider the cost as well as the availability of the treatment (Akobeng, 2005). The doctor has a responsibility to the individual patient, but if all the resources are spent on one patient, the other patients that doctor is responsible for could then suffer. Patients should be treated as individuals, but the wider picture does have to be considered (Dickenson & Vineis, 2002).

2.4.9.11 Lack of Conclusive Proof

One of the major drawbacks with the practice of EBM is that there will never be conclusive proof that the principle works. This is because it would be impossible to actually undertake a randomised control trial since there would be problems with contamination and blinding. The research proposal would be unlikely to pass ethical approval as the evidence would have to be withheld from the control group (Straus & McAlister, 2000). There have also been no conclusive studies showing patients whose doctors practice EBM are better off that those whose doctors do not practice EBM.

2.4.9.12 Clinical Guidelines

The solution to avoid every single doctor locating and appraising evidence for each disease, condition and potential treatment is the development of guidelines. However, these can be expensive, take time to develop and then require regular updating (Godlee, 1998). It is worth noting that guidelines are written using the best evidence at the time they were created, so the "best" guidelines are dated and usually include a "best before" date (Shaughnessy, Slawson & Bennett, 1994). The source or author of the guideline is important if it is to be implemented in the "real world". Guidelines developed in the UK by the Royal Colleges or NICE have the necessary weight and authority. The most suitable guidelines are recommended by panels representing a range of viewpoints, including patients (Fletcher & Fletcher, 1997). The guideline must also be promoted effectively; otherwise their development was a waste of time and money (Davis & Taylor-Vaisey, 1997). One issue with guidelines is they are fairly dogmatic, which means integrating patient values and resource issues can be problematic (Del Mar & Glasziou, 2001). However, even if guidelines are in place nationally, the quality of care patients receive at the local level can vary (Bauchner, Simpson & Chessare, 2001).

2.4.10 Research into the Use and Understanding of EBM

A questionnaire study undertaken in Denmark included questions on EBM methodological terms, including one "dummy" term (Oliveri, Gluud & Willie-Jørgensen, 2004). Of the doctors who responded to the survey, 4% felt confident enough in their understanding of all twelve terms to explain them to others. Encouragingly, 18% of doctors believed they "always" practised EBM and 66% "sometimes". However, worryingly, 56% understood or were aware of the "dummy" EBM term.

A self-rating survey by doctors to quantify their ability to appraise statistics found that key EBM terms were not readily understood. The term NNT (Number Needed to Treat) were used by 44% (Cowling, Newman & Leigh, 1999). Several studies have investigated acute-sector doctors understandings of EBM terms. Responses to the option "understand and can explain it to others" for the term NNT have generally risen over time 57% (Poolman et al., 2007), 47% (Sur et al., 2006) and 45% (Oliveri, Gluud & Willie-Jørgensen, 2004) with a 2003 study of 59% an exception (Veness, Rikard-Bell & Ward, 2003). Research in primary practice produced lower responses with only 33% "understanding and able to explain to others" (Callen, Fennell & McIntosh, 2006), 16% (Young, Glasziou & Ward, 2002) and 35% (McColl et al., 1998). The exception to this is the study by O'Donnell (2004) with a response to this question of 78%. A study by Estellat et al. (2006) asked doctors to define terms and undertake calculations which were then marked. This research considered actual skills and not perception of skills. Sixty-five percent of respondents were marked as correctly understanding and using the term NNT.

In December 2000 a postal survey was distributed to Australian and New Zealand radiation oncologists and registrars to determine their attitudes towards EBM (Veness, Rikard-Bell & Ward, 2003). Overall, the majority felt that practising EBM improved patient care (29% strongly agreed and 62% agreed). When asked if they thought EBM actually failed in practice, 65% disagreed or strongly disagreed. Approximately half of the respondents did feel that the explosion in medical information was overwhelming.

In another study, doctors were asked whether they believed there was "little or no evidence to guide practice" (Tracy et al., 2003). Just under half (48%) disagreed with this statement, with a further 15% undecided. Those who agreed with this statement (37%) may in fact be drowning in information, so not able to locate the relevant evidence.

Doctors' perceptions and attitudes towards EBM have been reported positively in previous research. A study by McAlister et al. (1999) found that 62% of general internists felt EBM improved patient outcomes, whilst 66% felt this was the case in a more recent study (Callen, Fennell & McIntosh, 2006). Two UK studies considered GPs' views towards the impact of EBM on improved patient care. The 2004 research found 84.4% of GP leads agreed that EBM improved patient care, whilst 70% responded positively in 1998 (O'Donnell, 2004; McColl et al., 1998). A study of hospital-based health professionals' attitudes towards Evidence-Based Medicine was undertaken in the UK in 1996 (Lewis, Urquhart & Rolinson, 1998). Over 95% of the doctors responded that they had heard of the term "EBM" and 89% felt they understood the term. However the doctors identified several perceived barriers to EBM, of which the time available to search was the major concern. A more recent study of junior doctors in the West Midlands identified doctors self-perception was that they required more training to develop the skills to practise EBM. However, these doctors did feel that EBM was essential to their clinical practice (Hadley, Wall & Khan, 2007).

2.4.11 Information Mastery

A development of the EBM principle is "Information Mastery". This is based on the "usefulness equation" (Shaughnessy, Slawson & Bennett, 1994, p.489):

$$\text{Usefulness of medical information} = \left[\frac{\text{relevance x validity}}{\text{work}}\right]$$

The usefulness equation is not mathematically calculable. It would really be more appropriate to describe this as a "concept".

Basically, the most useful information is highly relevant and valid, with little work needed to locate the information. The more work in time, money and effort required to locate the information the less useful the information (Boon, 2005). Doctors should be encouraged to look at "pre-digested" sources of information such as the Cochrane Collaboration (Ebell, 2003). One important aspect is the development of POEMs or "Patient Oriented Evidence that Matters". POEMs focus on clinical questions and measure outcomes that are relevant to doctors and their patients, such as symptoms, side effects, morbidity and quality of life. POEMs should also lead to a change in practice (PJ Online, 2006). However, a study found that the POEM results produced by the UK Prospective Diabetes Study (UKPDS) did not accurately disseminate review articles on the treatment of Type II diabetes (Shaughnessy & Slawson, 2003). This means that the latest evidence had not necessarily been utilised in the review articles.

2.5 Information Technology in the NHS

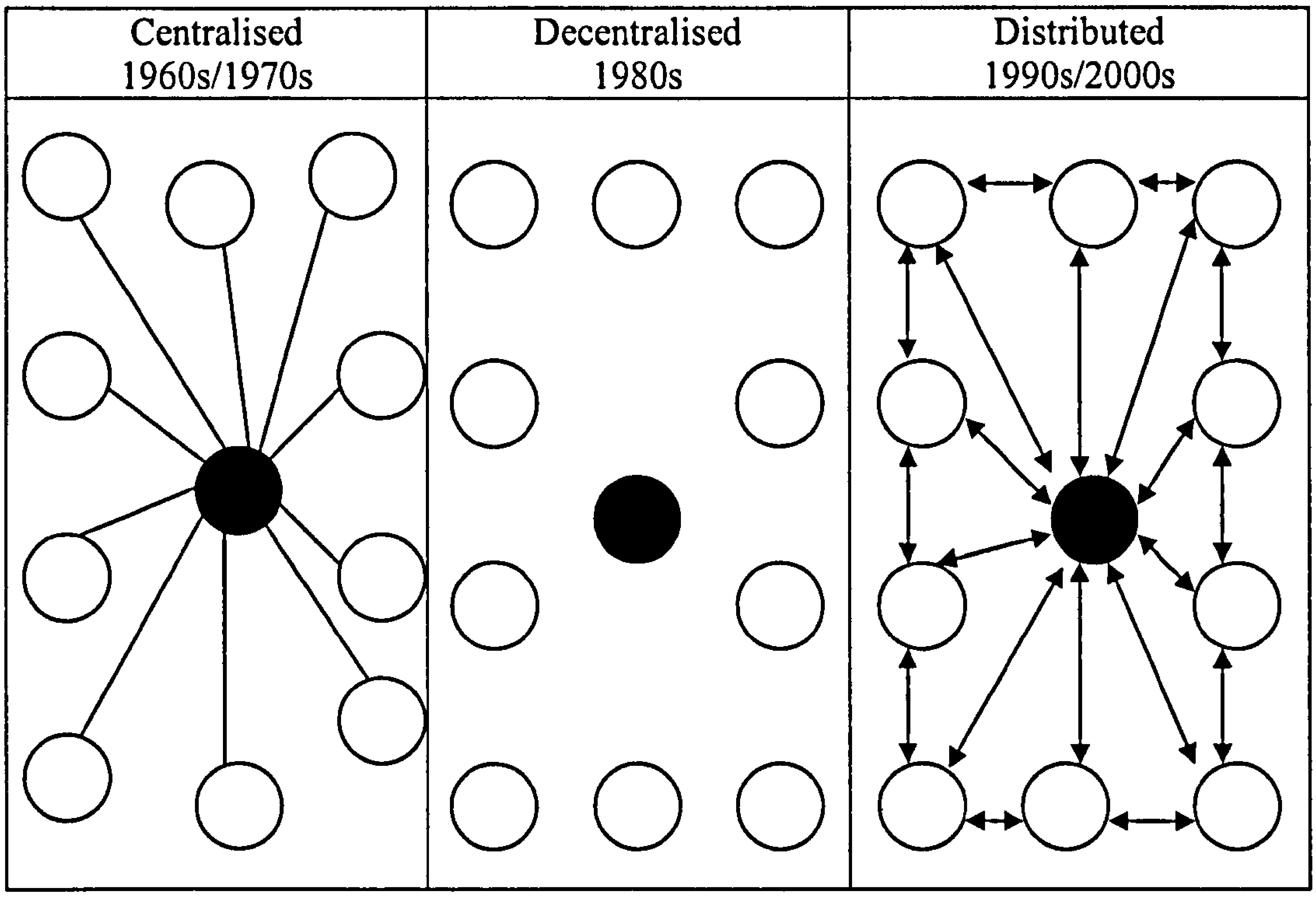
2.5.1 Introduction

Information Technology (IT) is an obvious necessity for the utilisation of electronic information resources. However, information provision is only a small element of healthcare provision that functions effectively electronically. Electronic information resources can be considered independently from other electronic systems utilised in the NHS.

However, providing the technology does not automatically result in a move towards efficient use of IT (Andrews et al., 2004). The benefits of the technology to potential users must be highlighted to encourage acceptance and then use.

2.5.2 IT Hardware in the NHS

Figure 2.14: Topographies of NHS IT structure covering five decades (1948-2003) (Guah & Currie, 2004, p.175)



In the 1960s/70s the NHS IT structure was "centralised", based on a collection of processors located in one site. The 1980s brought "decentralisation" where a number of processors in different locations, functioned autonomously. The 1990s/2000s saw the development of a "distributed" network with a number of processors, in different locations, linked by a common communications network (Guah & Currie, 2004). This highlights the dynamic ever-changing IT infrastructure of the NHS, illustrated in Figure 2.14. The development of this distributed network enabled the effective utilisation of electronic information resources.

Hospitals started using computers in the late 1960s, but this was mainly for administrative purposes. Medical staff were not expected to utilise computers at this time and no electronic information resources had yet been developed.

Computers were first installed in GP practices in the early 1980s. The 1982 trial "micros for GPs" provided 150 practices with assistance to buy microcomputers. The project was extremely popular with nearly 2,000 practices applying to participate (Rivett, 1997). The 1990 contract for GPs linked earnings to specific government targets such as childhood immunisation and cervical smear tests (Brennan, 2005). Computerisation assists in the recording and analysing of such data. Therefore, by 1995, 90% of practices were computerised (Rivett, 1997). However whilst computers are in GP practices, this does not mean that GPs themselves are using them. The data collected for government targets can be undertaken by administrative staff, not necessarily the GP.

2.5.3 Previous NHS IT Projects

The 1990s saw an ambitious IT project which attempted to convince users within Wessex (from Basingstoke to Dorchester, including Salisbury, Portsmouth, Southampton and Bath) to use the same computer system. Years later, computers remained in their original boxes (Brennan, 2005).

More recently has been the failure in the introduction of the online Medical Training Application Service (MTAS). The website crashed (BMA, 2007) and there were issues with the security of information (Fleming & Condron, 2007). The website was suspended and was still inactive in August 2007; six months after the first problems were identified (https://www.mtas.nhs.uk/).

These two IT projects failed for various reasons. However, there are some fundamental lessons that can be drawn from these failures. The key point is that users' needs were not considered. The Wessex example with computers being left unused illustrates that the individual potential users failed to see the benefit to them individually in using the computers. User involvement in the whole process is vital to encourage a feeling of "user ownership" (Coombs, Doherty & Loan-Clarke, 2001). The recent failure of the MTAS (Medical Training Application Service) showed the lack of trust users had with a system when it is "forced" on to users.

There have been successful IT projects in the NHS. These include (Brennan, 2005):

- Patient Administration Systems (PAS), used to schedule and manage patient appointments / hospital stays;
- Pathology laboratory systems that deliver diagnostic services;
- Radiology Information System (RIS) support the management of patients requiring an X-rays or other images.

In some cases the IT system has survived because it has actually served a purpose (Brennan, 2005). These systems provide "operative information". This is necessary for activities so are successful even if this has not been in the most efficient or user-friendly manner (Malmsjö, 1997, p.224).

Protti (2002) considered the factors that may predict the success of electronic patient records (EPR) or electronic health records being implemented. Whilst the Protti research focussed on the specialised area of EPR, the results suggest factors that should be considered in the development, implementation and management of other IT projects. The top two factors consistently associated with successful projects are "top management support" and "user involvement".

The NHSnet was devised in the early 1990s and is therefore a pre-Internet concept. It was designed to link all hospitals' computer systems together and connect to GP practices (NHS Executive, 1998). NHSnet allows users to connect to the WWW and to send e-mails to those outside NHSnet (Dale & Lau, 2000).

A survey of general practices in the Northern and Yorkshire region found 59% used NHSnet at least once a week (Wilson, Glanville & Watt, 2003). Those who rarely used NHSnet gave various explanations. The two main reasons were lack of time and inability (that is, lack of skills or confidence) in using the site (Wilson, Glanville & Watt, 2003).

2.5.4 NHS Connecting For Health

The ten-year National Programme for IT ("NPfIT") started in October 2002 (National Audit Office, 2006). Due to political devolution, this programme only covers England (Royal Society, 2006). NPfIT is not a single computer or computer system. There are several elements to the programme, but these are all connectable, which is a new concept for the NHS (Brennan, 2005). The NPfIT programme is ambitious. Steps have been also taken to address the issue of project size by breaking down the whole project into smaller components. A detailed timetable has also been published with regular updates so progress can be monitored by potential users of the systems (http://www.connectingforhealth.nhs.uk/newsroom/latest/factsandfigures).

However, one area of concern is user involvement and addressing the concerns raised by the intended users. This point must be addressed to ensure the success of the whole IT project (Coombs, Doherty & Loan-Clarke, 2001). People make or break IT projects, not the technology.

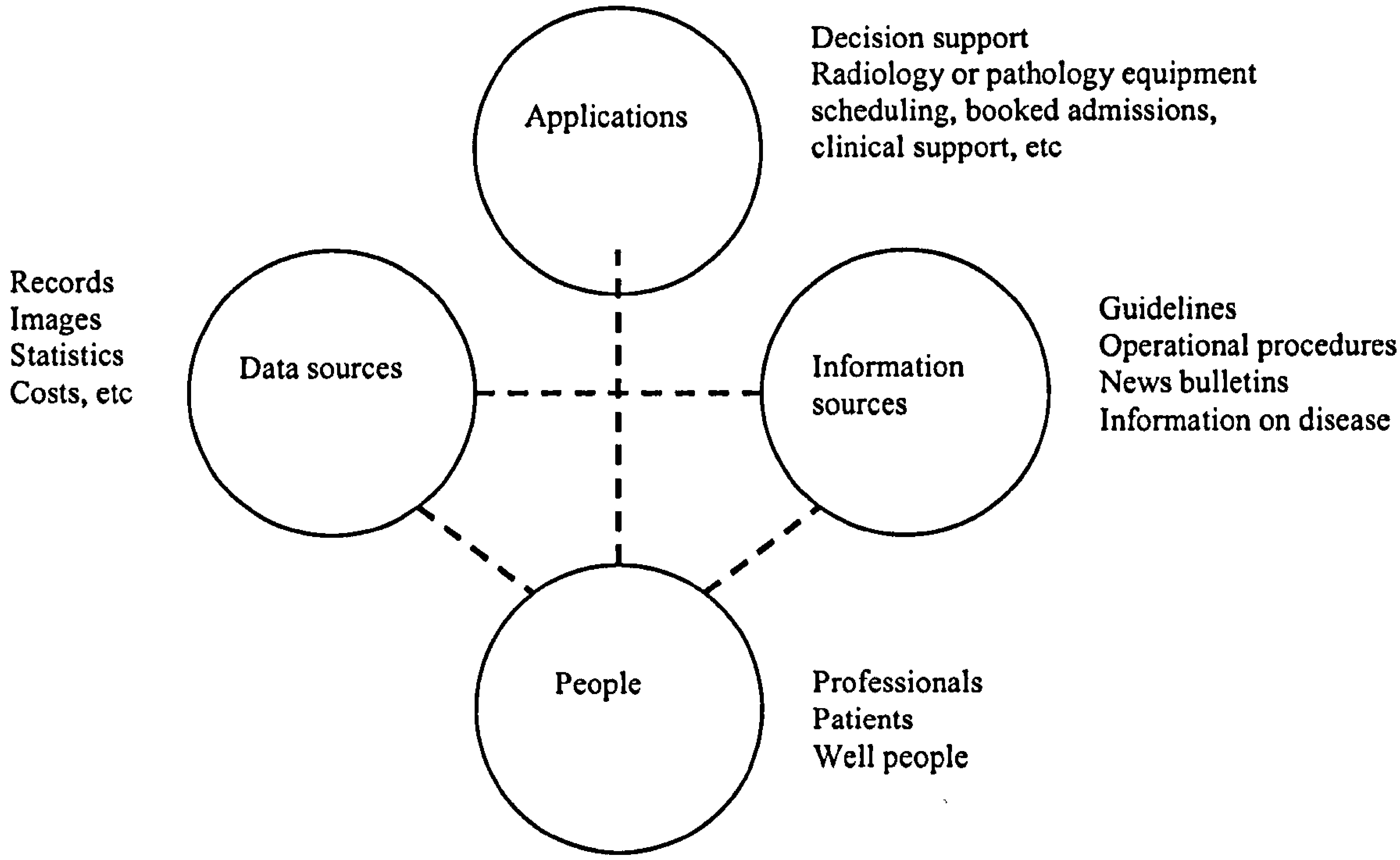
The NPfIT built on previous Department of Health reports such as the 1992 IM&T Infrastructure Overview. The key principles of this were (NHS Management Executive, 1992):

- Information will be person-based;
- Systems may be integrated;
- Information will be derived from operational systems;
- Information will be secure and confidential;
- Information will be shared across the NHS.

The 1998 NHS Executive report, Information for Health, restated these same principles.

In April 2005 NPfIT became NHS Connecting for Health (National Audit Office, 2006). Connecting for Health aims to connect sources of healthcare knowledge and information to enable effective patient care management. This concept is illustrated in the Figure 2.15 by Currie & Guah (2006, p.18).

Figure 2.15: Connecting sources of healthcare knowledge for data transfer (Currie & Guah, 2006, p.18)



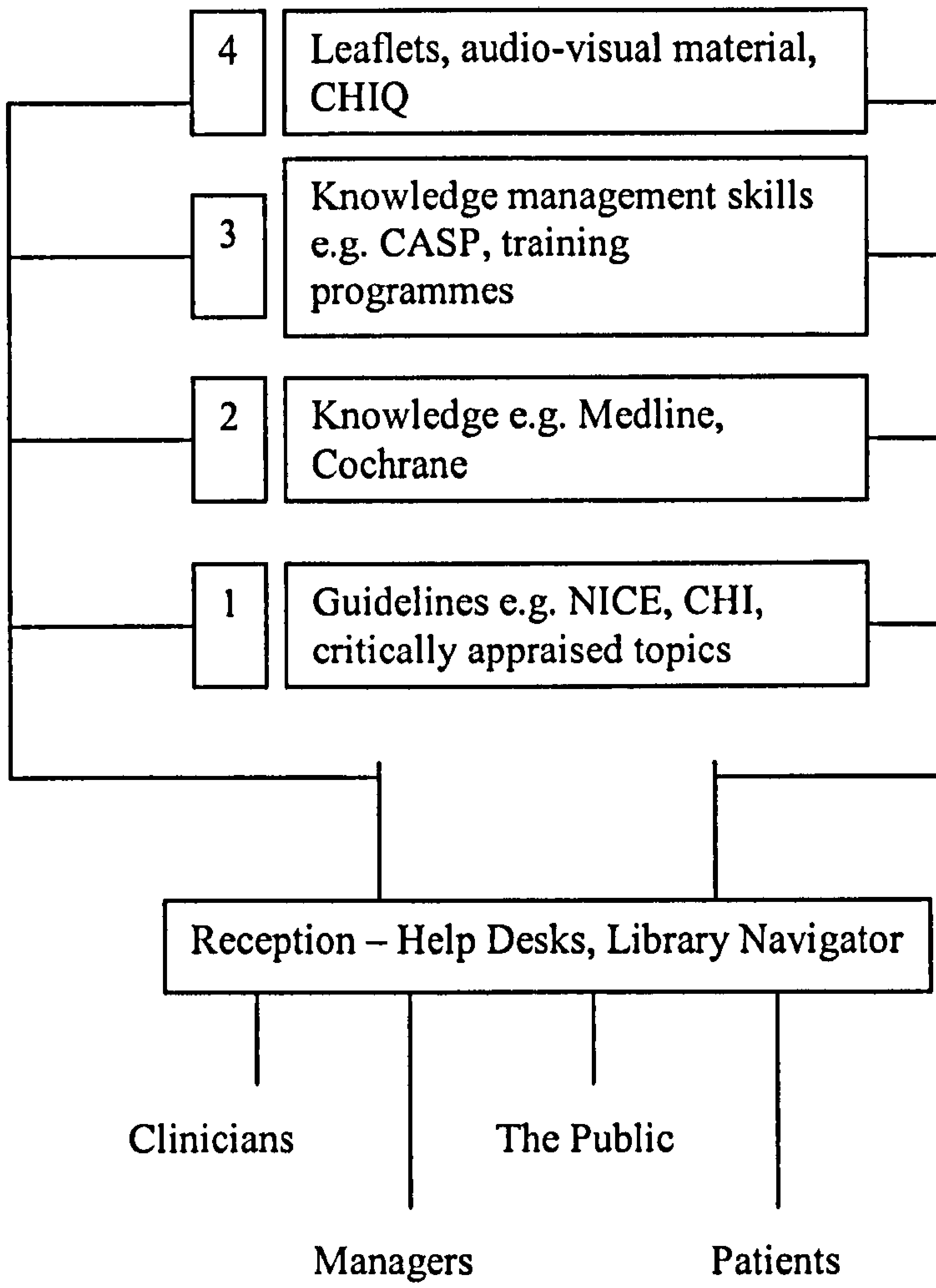
2.5.5 National Library for Health

The 1998 NHS information strategy "Information for Health" committed the NHS to 24/7 "on-line access to information about best clinical practice, for all NHS clinicians" (NHS Executive, 1998, p.9). This document stressed the importance of health professionals being able to access local and national knowledge bases that support patient care quickly and easily. A specific target outlined in Information for Health was the creation of a National electronic Library for Health on NHSnet. This would provide electronic access to information on the latest treatments and evidence of best practice (Department of Health, 2000).

NHS Scotland has undertaken a similar programme creating an e-Library (http://www.elib.scot.nhs.uk) that provides a knowledge infrastructure for the whole of the country (Wales, 2005).

The structure of the National Electronic Library for Health was envisaged to resemble Figure 2.16 (NHS Executive, 1998, p.58).

Figure 2.16: The National Electronic Library for Health (NHS Executive, 1998, p.58)



The full pilot National electronic Library for Health was launched in November 2000 (Department of Health, 2001). The website provided access to online "knowledge" and "know how" sections, including resources such as Clinical Evidence, Bandolier and the Cochrane Library. This is the "supportive" information required to practice medicine in an EBM environment (Malmsjö, 1997, p.224).

The National Library for Health (NLH) aims to (NHS Connecting for Health, 2006, p.4):

- Deliver a modern library service to all NHS staff;
- Be built around user need;
- Integrate the library services with NHS Connecting for Health and other services;
- Reach NHS staff that do not currently regularly use NHS library services.

The "Implementing the NHS Plan – Building the information core" published in January 2001 set the target that 95% of GP practices and 25% of Trust clinical staff would have access to NHSnet and be able to use NHS information services such as the National electronic Library for Health, by March 2001 (Department of Health, 2001). This should enable all staff to be able to access electronic information sources.

The National Core Content Project was established in August 2002 to centrally procure electronic resources that had previously been regionally acquired (Honeybourne, Marriott & Morley, 2006). National procurement should strengthen the bargaining position of the English NHS and reduce the total amount of staff time (and cost) regionally purchasing the resources. The NHS National Core Content Service was launched in April 2005 to replace the project (Honeybourne, Marriott & Morley, 2006).

A report on the National Core Content Service between April 2005 and March 2006 reviewed the access and use of resources purchased centrally. Those particularly relevant to patient care include (Honeybourne, Marriott & Morley, 2006):

- Thomson Dialog Datastar Databases encompassing Medline, Embase and the Kings Fund. Doctors accounted for 13% of users, consultants 4% and GPs 1%;
- Proquest Journals including The Lancet, Journal of Bone and Joint Surgery, The New England Journal of Medicine (with a ninety day embargo), British

Medical Journal (BMJ), The Journal of the American Medical Association (removed in December 2005), Chest and Pediatrics;

- Images.MD is a database of over 50,000 internal medicine images;
- MyiLibrary offers access to a range of electronic books, including a large section on mental health. Doctors accounted for 17% of electronic book users, consultants 5% and GPs 2%.

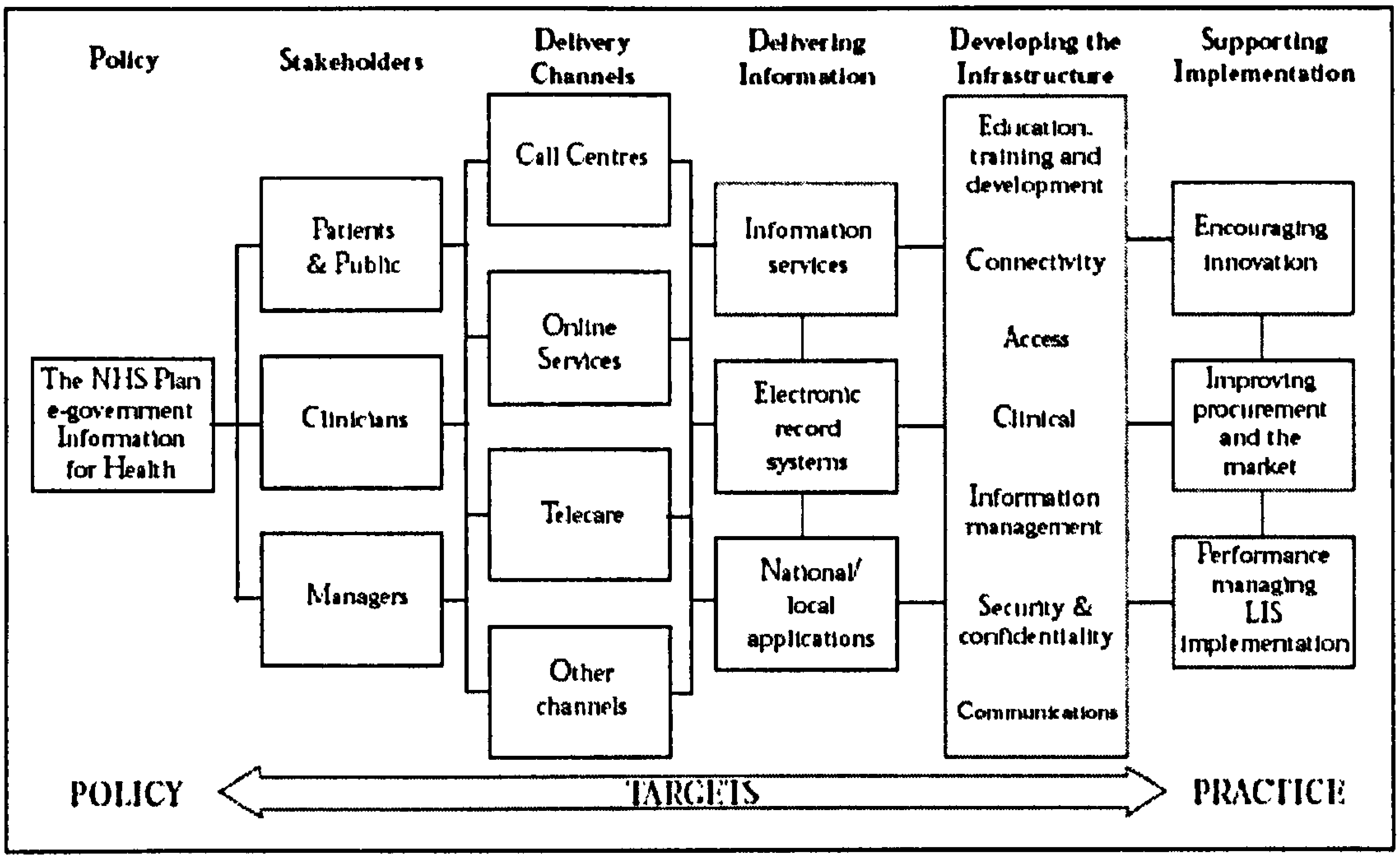
Between 2006 and 2008 the NLH intends to deliver a number of strategic services, including comprehensive resource location; document delivery; and clinical question answering (NHS Connecting for Health, 2006).

However "just assembling the right words and data is not enough to ensure that better decisions will be taken" (Wyatt, 1999, p.1501). The NLH provides the necessary access to information, but doctors must be encouraged to use this resource (as well as other EBM resources) and change clinical practice if applicable.

2.5.6 Standards in the NHS

The model, Figure 2.17, illustrates the transition between policy and practice, physically and electronically. Electronic information resources are part of "information services", under the heading "Delivering Information".

Figure 2.17: The Information Core (Department of Health, 2001, p.22)



The methods of delivering information must be supported by appropriate standards. Four examples of standardisation which support UK e-Health are (Thorp, [n.d.]):

- Technical standards. NHS Connecting for Health is a member of the Continua Health Alliance, an international collaboration concerned with standards;
- Communication standards. NHS Connecting for Health is a member of HL7, who define standard messages to support health interactions;
- Terminology standards. Effective communication of information depends on clear and unambiguous terminology. The UK has been involved in the development of the SNOMED Clinical Terms;
- Information Governance. This is relatively new so the UK developments should contribute to the knowledge base for use internationally.

The NHS Information Standards Board, established in 2001, provides an independent mechanism for the assurance of Information Standards for use in the English NHS (Thorp, [n.d.]). Standardisation activities take place at the UK national level (through BSI) and internationally (through CEN and ISO) (The Royal Society, 2006).

Security of the information in the NHS is an important consideration. The NHS adopted the BS7799 national standard which is already used in UK business and other public sector bodies (Department of Health, 2001). The Connecting for Health programme intends to utilise smart cards to enable authorised access to individual patient records (Chantler, Clarke & Granger, 2006).

3 Methodology

The methodology chapter considers the theoretical framework for this research. The data collection techniques utilised in the research are also outlined.

3.1 Definitions

Research paradigm – a cluster of beliefs that influences, for example, what should be studied, how the research should be undertaken and how the results should be interpreted (Bryman, 1988). Similarly, Neuman (2005, p.81) categorised a paradigm to be a "general organising framework for the theory and research that includes basic assumptions, models of quality research, and methods for seeking answers".

Methodology - the theory of how the study should proceed. The methodology sits between the philosophy of the research paradigm and the actual methods used in the study (O'Leary, 2004).

Method - the tools or techniques that are utilised by the researcher to gather the data for analysis (Creswell, 2003).

Techniques or tools - the actual devices that will be utilised to collect the data, such as questionnaires and interview schedules (O'Leary, 2004).

Figure 3.1: The Research Hierarchy (derived from Pickard, 2007, p.xv)

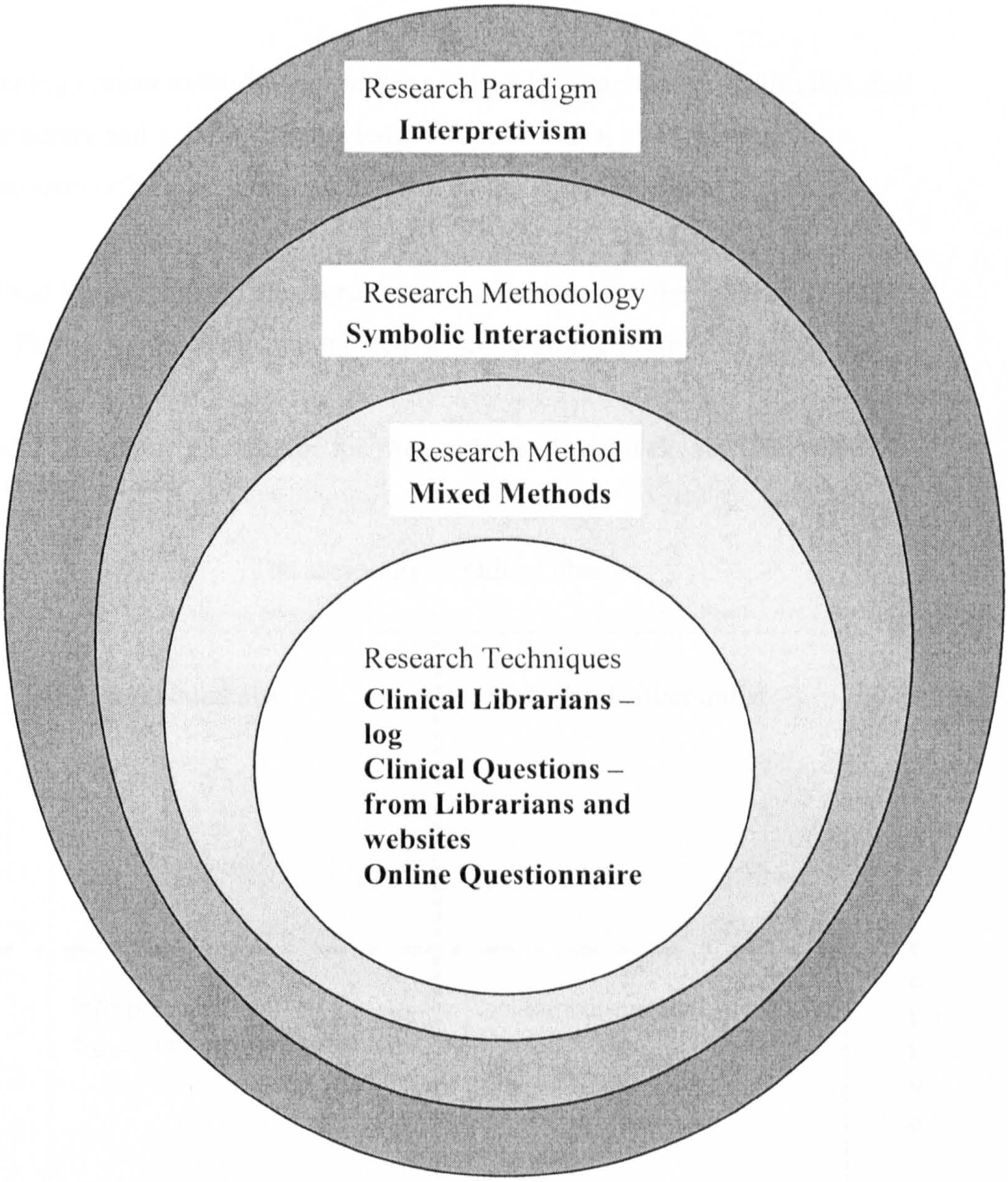


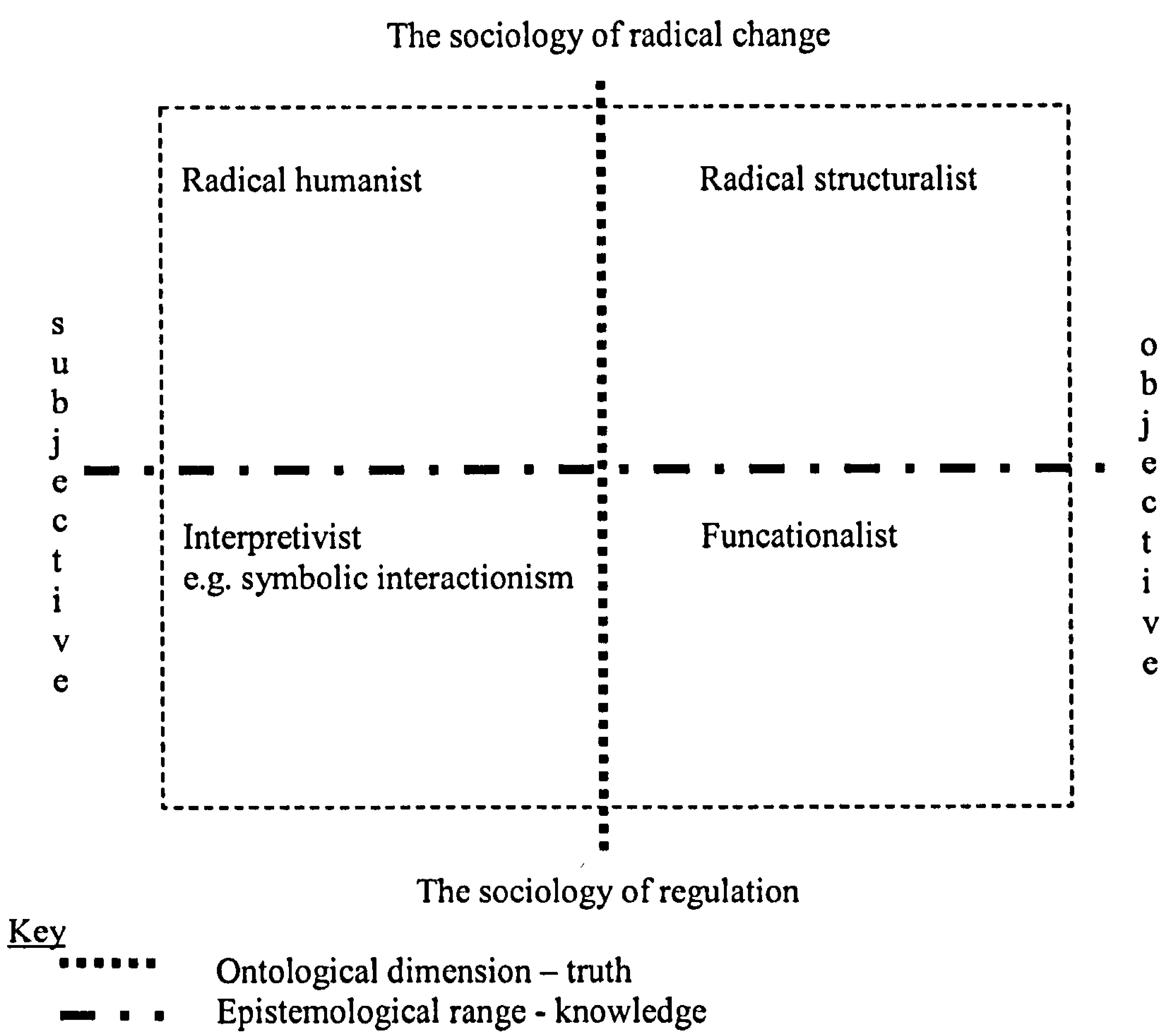
Figure 3.1 illustrates the research paradigm, methodology, method and research techniques that have been utilised in this research (derived from Pickard, 2007, p.xv).

3.2 Research Paradigm: Interpretivism

Epistemology refers to the "theory of knowledge" by undertaking studies that deal with the nature and validity of knowledge (Pope & Mays, 1995, p.43). Interpretivism reflects an epistemological position (Bryman, 2004).

Burrell and Morgan (1979) produced the four paradigms for the analysis of social theory. Figure 3.2 illustrates the subjective nature of interpretivist research.

Figure 3.2: The four paradigms for the analysis of social theory (Burrell & Morgan, 1979, p.22)



Interpretivism is derived from the Latin interpretari which means "to explain or understand" (http://www.ismbook.com/interpretivism.html).

Interpretivists maintain that the natural science methods, such as those advocated by positivists, are not suitable for social and human investigations. The social world and interactions between people do not support law-like, fixed-fact restrictions (Snape & Spencer, 2003). Interpretivism respects and acknowledges the difference between people and the natural sciences (Crotty, 1998). In fact, interpretivism reflects the distinctiveness of humans (Bryman, 2004).

The interpretivist approach looks for culturally derived interpretations of the social life-world (Crotty, 1998). Social reality is a subjective construction interpreted by humans. The social world is not tangible and cannot be measured in a literal manner. It is really only constructed in the minds of people. Therefore, interpretivists focus on the way people make sense of the world and how they create their social worlds through their actions and interpretations (Denscombe, 2002). This reality is always shifting, so long-term fixed conclusions from research cannot be drawn. Results and their tentative conclusions only point to a specific point in time.

Interpretivism is linked to the work of Max Weber who suggested that research with humans is concerned with "verstehen" or understanding. This contrasts with positivism or research in the natural sciences, which focuses on "erklären"; explaining or predicting (Crotty, 1998). In fact, Weber appears to suggest that human research requires both understanding and explaining. However, this explaining must be in context with the interpreting and understanding of "social action" (Bryman, 2004). Weber defines social action as a social actor assigning a certain meaning to their conduct and thus it is related to the behaviour of other people. Social interaction occurs when actions are reciprocally oriented towards the actions of others. Actions are reciprocally oriented when actors interpret and assign meanings to their own and others behaviour (Hughes, 1990). It is important that researchers understand the difference between humans in their role as social actors (Saunders, Lewis & Thornhill, 2007).

Interpretivists assert (Cohen et al., 2000):

- Humans are active, conscious beings, who make intentional choices;
- People do not simply respond to external stimuli but actively interpret the world, based on their experiences and interactions;
- People construct their own social world;
- Meaning is imposed by the individual so generalisations are difficult;
- There are many ways (multiple perspectives) of structuring the world and its entities;
- Realities are multi-layered, complex and holistic;
- Realities can differ across time and place as the real world is fluid, not static;
- Reality can only be defined subjectively;
- Situations and events need to be understood from the "inside", through the eyes of the participants;
- Understanding cannot be derived from descriptions, but must be based on interpretations (Henn, Weinstein & Foard, 2006);
- The social world should be studied in its natural state to really understand the behaviour and actions of the social actors (Henn, Weinstein & Foard, 2006).

Quantitative measures narrow and limit experiences by directing the research through standardised tools based on quantifying data to test hypothesis (Robson, 2002). The interpretivist paradigm generally leads to the use of qualitative research methods that enable the researcher to gain a descriptive understanding of the values, actions and concerns of the subjects under study. Since the researcher must interpret the findings, there is always the possibility that another researcher will arrive at different conclusions (Denscombe, 2002). Another issue is that actually researching individuals and focussing attention on them may cause them to act differently, thereby distorting their normal behaviour and the results of the research (Denscombe, 2002). The final aspect is that data must not be invented or misrepresented (Mason, 2002). Results should be reported and tentative conclusions drawn, but the researcher must ensure they do not impose their views or bias on the results.

Interpretivism takes what positivism ignores, that is, the meanings and interpretations that people use in their everyday lives, and which direct their behaviour. In interpretivism, the social world is the world perceived and experienced from the inside. The aim of researchers is to discover and describe this insider view, not to impose an outsider view (Mason, 2002).

Since humans do make their own conscious decisions, determining why individual doctors select particular resources would not produce results that could be generalised for the larger population. There are several resources that may suit one purpose and the decision to use a particular resource is personal to each individual. For example Clinical Evidence and Evidence-Based On-Call both provide evidence-based summaries of medical conditions, so the decision on which to use is driven by personal preference. Individuals interpret the world based on their experiences. Therefore, doctors are likely to select information resources that have previously provided information to answer clinical questions. The range of information resources available to doctors is vast, so the different options selected lead to a variety of social world perspectives, which again mean that it is difficult to generalise for the whole population. Medicine is a particularly dynamic field with constant changes and developments, which reflects the fact that the real world is not static. Databases and their search engines are amended over time which can encourage or discourage doctors to use them, again illustrating the fluid nature of the real world.

Interpretivist research can only be carried out in the real world and not from experiments in artificial environments. The researcher has to approach this as an "insider". Therefore, interpretivism would seem to support the concept of user-centred research as outlined by the models in the literature review by Leckie & Pettigrew (1997), Malmsjö (1996), Wilson (1994), Krikelas (1983), Wilson (1981) and Lor (1979). The users, in this case qualified doctors, are the focus of the investigation. Whilst generalisations are unlikely to be drawn from the data, the data still need to be analysed to understand and interpret the social world of the doctors investigated. This research will be conducted in a non-intrusive manner to ensure that the data are collected by methods that do not impact on the natural world of the subjects, so that their real world can be investigated.

There are several criticisms associated with interpretivism. The first issue is that social actors do not continuously monitor their conduct, which means interpretivist research is problematic in practice. In the real world, many actions are instinctive, rather than processed, evaluated and then acted upon. In fact, most everyday activity is routine and largely unmotivated. Secondly, external pressures and forces such as government, politics and economics are not acknowledged within the social interactions in interpretivism (Bloor & Wood, 2006). Thirdly, there is no account of historical changes in interpretivism. Interpretivism provides a "snap-shot" of the present situation and can neither look back into the past nor predict the future. Fourthly, human action has little inherent meaning, though people with the same "meaning system" can attribute that same action the same meaning. However, these meanings may be different depending on the meaning system that the social actors share and so are not uniformly standard across the UK (Neuman, 2005). Despite these accepted criticisms, interpretivism is imminently suitable for research using human participants and has therefore formed the foundation for this research.

3.3 Research Methodology: Symbolic Interactionism

Symbolic interactionism is drawn from the thoughts of George Herbert Mead. One of his students, Herbert Blumer outlined three basic interactionist assumptions (Crotty, 1998):

1. People act towards objects and other people on the basis of the meanings that these have for them;
2. These meanings derive from the social interaction between and among individuals;
3. These meanings are modified through an interpretive process undertaken by the individual actor.

Symbolic interactionists suggest that interaction involves individuals interpreting the environment and the actions of others, and then acting on this attributed meaning (Gray, 2004). This is a continual process (Saunders, Lewis & Thornhill, 2007). Meanings are not fixed as individuals revise them on the basis of everyday life experiences (Gray, 2004). Therefore, research results can only provide indications and are not suitable for long-term conclusions.

Researchers must enter the life-world of the research subjects and understand the world from their point of view. This takes into account people's different perceptions of objects and life events / experiences (Flick, 2006). An individual's perception of the world is not a direct reflection of their life events / experiences, but their specific interpretation of these. An empathetic stance from the researcher is crucial to this understanding (Saunders, Lewis & Thornhill, 2007).

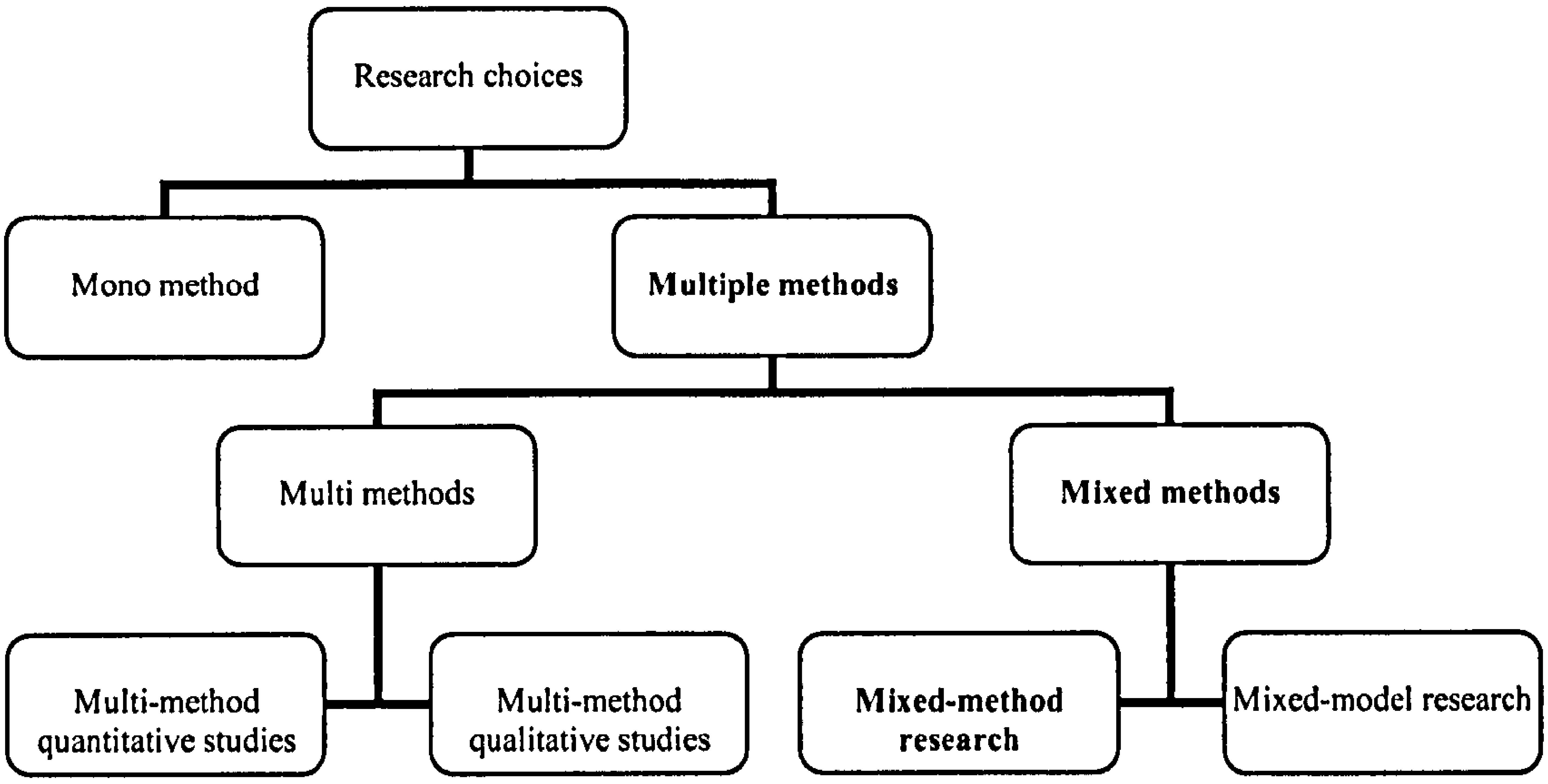
Symbolic interactionism research is commonly undertaken by direct participant observation. However, Blumer mentioned other methods such as interviews and document analysis of letters and diaries (Bryman, 1988). This research utilised clinical librarians' logs which are a direct substitute for participant observation by the research author. Clinical librarians undertook the role of "observers" noting down the questions asked by doctors. The clinical questions (from medical librarians) is a similar data collection method to a diary, with librarians sending questions they received from doctors in a specific time frame (which varied according to the number of questions they received per month). The questionnaire did ask qualitative, subjective questions, such as the attitudes and views towards EBM.

The researcher needs to place the interpretations obtained into the relevant social framework (Bryman, 2004). In this research, the interpretations need to be considered within the healthcare framework, specifically the NHS.

3.4 Research Method: Mixed Methods

Figure 3.3 illustrates where mixed methods fits into the research choice according to Saunders, Lewis & Thornhill (2007, p.146).

Figure 3.3: Mixed Methods Research Choice (Saunders, Lewis & Thornhill, 2007, p.146)



3.4.1 Quantitative Research

Quantitative indicates something that can be expressed in terms of quantity and is normally considered to be numeric or statistical data. This approach measures objective facts (Neuman, 2005). The data collection methods include structured questionnaires and tests (Creswell, 2003).

3.4.2 Qualitative Research

Qualitative research is often concerned with meanings (and the way people understand things) or peoples patterns of behaviour (Denscombe, 2003). This approach constructs social reality from the cultural meanings identified (Neuman, 2005).

Qualitative data are non-numeric data usually taking the form of words (Bryman, 2004). The data collection methods include interviews, observations and document (or text) collection (Creswell, 2003).

3.4.3 Mixed Methods - Combining Quantitative and Qualitative

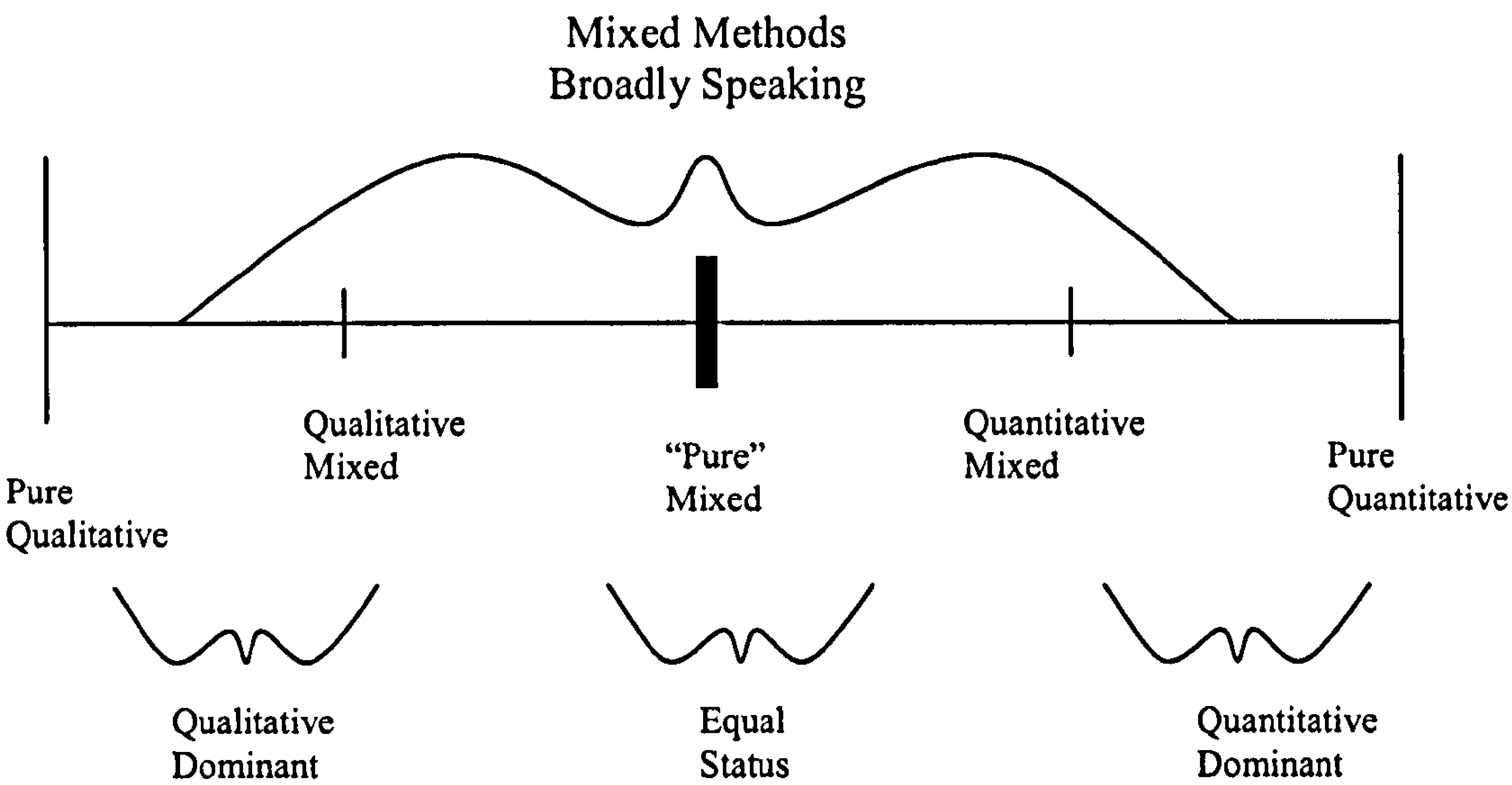
Quantitative and qualitative research methods can be combined which is often referred to as "Mixed Methods". Greene, Caracelli & Graham (1989, p.256) defined mixed methods research to be "those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words)". In mixed methods research "the end product is more than the sum of the individual quantitative and qualitative parts" (Bryman, 2007, p.8). Utilising mixed methods may also counteract the bias involved in using one research method (Greene, Caracelli & Graham, 1989).

Johnson, Onwuegbuzie & Turner (2007, p.123) analysed definitions from current leaders in mixed methods research to produce the following definition:

> "Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration."

Mixed methods research can be qualitatively dominated, quantitatively dominated or equally focussed. Qualitatively dominated research can be referred to as "QUAL + quan" research and conversely quantitatively dominated research as "QUAN + qual", with the capital letters illustrating the dominant approach (Johnson, Onwuegbuzie & Turner, 2007). These three "subtypes" of mixed methods research are illustrated in Figure 3.4.

Figure 3.4: Three Subtypes of Mixed Methods Research (Johnson, Onwuegbuzie & Turner, 2007, p.124)



This research is really "pure mixed" as both quantitative and qualitative research techniques are implemented equally. The clinical librarian's log is quantitative as this is basically a numeric count of questions asked by doctors. The clinical question analysis (type) is both qualitative and quantitative as the questions were analysed utilising a taxonomy (qualitative) and then the totals for each question calculated (quantitative). Most of the questions on the questionnaire are subjective and attitudinal, therefore a qualitative focus.

Sequential procedures occur when the findings from one method are expanded by using another method (Creswell, 2003). Concurrent procedures are where both quantitative and qualitative research methods are used simultaneously to provide comprehensive data that can then be analysed to address the research problem (Creswell, 2003). In this case, the three main data collection methods, the clinical librarian logs, medical librarian's clinical question databases and online questionnaire were collected concurrently. These data were used to determine the frequency and type of information need doctors experience, followed by identifying how they would locate the information to answer their information needs.

There is disagreement amongst mixed methods practitioners as to whether for the research to be truly classed as "mixed methods" the results must be "integrated". This is partly due to the lack of "exemplars" or models of excellence in mixed methods research (Bryman, 2007, p.21). Tashakkori & Creswell (2007) suggest that mixed methods research should "clearly integrate the results of two or more (qualitative and quantitative) strands of the study into coherent conclusions or inferences that are more comprehensive and meaningful that those of the qualitative or quantitative strands alone" (p.207). Mason (2006) suggests "meshing" or "linking" the data rather than pure integration. "Meshing" can be used to describe how the discussion has been written up in this research. The discussion chapter has been presented with the results from the different data collection methods "meshed" together to form one complete piece of writing. The "meshing" in this research enables the frequency of information needs (clinical librarians log), type of information need (clinical questions and questionnaire data) and answering information needs (questionnaire data) to be presented as one piece of writing. This produces more meaningful "conclusions and inferences" than would have been possible from one data collection method (Tashakkori & Creswell, 2007). This justifies the use of "meshed" results rather than "integrated".

The results in this research are presented sequentially to illustrate the information-seeking progression of information need, information question and resources utilised to answer that initial information need. The discussion presents the findings in a "meshed" manner, integrating the results from different data collection methods to provide an overview holistically of the information-seeking behaviour of UK doctors.

Mixed methods research in the healthcare environment reflects the management of patient care. Collecting patient histories and consulting with colleagues are qualitative techniques, whilst the data gathered from physical examinations and laboratory results are quantitative in nature. All this information is then integrated to treat and manage a specific patient.

3.5 Triangulation

Triangulation involves using more than one source to improve the rigour of the research. Denzin suggested four basic types of triangulation (Robson, 2002; Tashakkori & Teddlie, 1998):

- Investigator triangulation – using several different researchers in the study;
- Theory triangulation – using multiple theories or perspectives to interpret the results of a study;
- Data triangulation – using a variety of data collection methods in a study, such as observations, documents and interviews;
- Methodological triangulation – combining quantitative and qualitative approaches to study the research problem.

This research involves data triangulation and methodological triangulation. The data sources utilised are clinical librarians' logs, medical librarians' databases of clinical questions and an online questionnaire. The methods utilised included quantitative (clinical librarians' logs), qualitative (medical librarians' databases of clinical questions) and quantitative / qualitative (online questionnaire).

This research is an example of between-method triangulation, which is combining different data collection methods (Flick, 2006).

Two previous research studies implemented a triangulation methodology using three methods to collect information. Covell et al. (1985) combined a questionnaire (40 closed response questions), office interviews (after each patient visit) and a closing interview at the end of the half day session. Cheng (2004) utilised mailed questionnaires, interviews and a randomised control trial (with one group attending a three hour workshop on information searching and the control group receiving no training).

3.6 Sampling

A sample is a portion of a larger group or population (Bryman, 2004). The population is the unique group being researched; in this case, UK-based qualified medical doctors.

One of the major limitations in many of the research studies was the small sample size used in the research (Bergus & Emerson, 2005; Sigouin & Jadad, 2002). This was further exacerbated by the low response rate, particularly with questionnaires (Sur et al., 2006; Sigouin & Jadad, 2002; Scott, Heyworth & Fairweather, 2000).

Research studies were also limited by their location (Ely et al., 2005; Rosenbloom et al., 2005; Tomlin, Humphrey & Rogers, 1999). Van Duppen et al. (2007) and Gill et al. (1996) utilised just one location in their studies so generalising the results is problematic. Location is not the only limiting factor in previous research. Ely et al. (2005) limited the participants in their research by excluding those over the age of 45 years.

The study itself may affect the results. It is more likely that those with an interest and/or skills in EBM will respond to the questionnaire in this area (Scott, Heyworth & Fairweather, 2000). Using the computer and Internet self-selects the study cohort (Magrabi et al., 2005), so is not truly representative of the whole population. Another issue is that self-reporting may be inaccurate as respondents present the "best case scenario" (Scott, Heyworth & Fairweather,, 2000, p.323). All three of these issues may affect this research. Since electronic EBM resources are being investigated an online questionnaire is logical. This is because EBM resources must be current and online resources can be easily, cost-effectively and quickly updated. Electronic resource updating also removes the previous version (as it is overwritten), whereas with print copies different versions may be in use at the same time. However, only using an online questionnaire does mean that non-computer users are automatically excluded from this research.

3.6.1 Convenience Sampling

Convenience sampling is a non-probability sample since the probability of the selection of each respondent is unknown (Robson, 2002). Convenience sampling involves drawing subjects from a group that are easily accessible by the researcher (Kemper, Stringfield & Teddlie, 2003). Sampling is undertaken on the basis of availability and ease of data collection (Tashakkori & Teddlie, 1998). The process continues until the required sample size has been obtained (Robson, 2002).

Non-randomisation of the research participants was an issue in previous research studies (Perley et al., 2007; Rosenbloom et al., 2005; Scott, Heyworth & Fairweather, 2000). Chambliss and Conley (1996) used "convenience sampling" which does not reflect the composition of the population.

From an interpretivist position, the validity of generalisation from a small number of results does not depend on the statistical representativeness of the results, but on the validity or reliability of the logical reasoning used in describing the results and drawing conclusions (Walsham, 1993). This suggests that convenience sampling should not automatically have a negative impact on this research. In fact both interpretivism and symbolic interactionism do not lend themselves to mass generalisation, so convenience sampling should not be an issue.

There is likely to be an academic bias to the results due to the manner in which these e-mail addresses were located, namely University Medical Schools and Health Sciences departments (Warwick, Newcastle, Sheffield and Leicester) and authors of journal articles (eBMJ).

The General Medical Council (GMC) was contacted by e-mail for information on the number of doctors registered. On the 12th April 2007 a response from them stated "I can confirm that there are currently 55239 GPs on the medical register" (Fricker, 2007a) Using this figure in the sample size calculator for a proportion (absolute margin) at http://www.berrie.dds.nl/calcss.htm with a 95% confidence interval rating produces a sample size of 382 (with a 0.05% margin). The responses received from the questionnaire (256) do not reach this figure. Further correspondence to identify the number of medically qualified doctors of any medical discipline registered to work in the UK received the response "currently 238676 doctors" (Fricker, 2007b). Using this figure in the sample size calculator for a proportion (absolute margin) with a 95% confidence interval rating produces a sample size of 384 (with a 0.05% margin). The responses from the questionnaire (636) exceed this figure.

3.7 Reliability and Validity

Reliable research should have data collection techniques and analysis methods that produce consistent findings when research is repeated under the same conditions (Case, 2006). The focal point of reliability is accuracy (Cohen et al., 2000). This is problematic with research using human participants. The results of this work reflect a particular point in time and repeating the research will mean that it is undertaken in a different real world. Therefore replicating results exactly is unlikely in interpretivist research.

A valid research data collection tool measures what it claims to measure (Saunders, Lewis & Thornhill, 2007). The possibility of the results being valid can be improved by (Cohen et al., 2000):

- Choosing an appropriate time scale for collecting the data;
- Ensuing adequate resources are available to undertake the research;
- Selecting appropriate research methodology;
- Using appropriate tools to collect the data;
- Ensuring consistent and robust analysis and interpretation of the data;
- Ensuring conclusions and interpretations are only derived from the data, not supposition.

None of the research methods utilised in this research offered any incentive to participants. All of the data were collected from volunteers who willing gave up their time with no remuneration.

3.8 Ethical Considerations

The University's Ethical Clearance Checklist was completed prior to the investigation commencing.

Informed consent consists of four elements, competence, voluntarism, full information and comprehension (Cohen et al., 2000). "Competence" refers to the responder being capable enough to respond adequately to the questions. "Voluntarism" means that respondents choose whether or not to participate, without coercion. "Full information" refers to the fact that participants should be told why the research is being undertaken and how the data is being collected / used. Participants should not be deceived or misled (Case, 2006). The "comprehension" relates to understanding, in this case understanding the research project in simplistic terms. In this research, competence is assured since all of the respondents to the questionnaire were qualified doctors and for the other two data collection methods the respondents were qualified librarians. The doctors and librarians were both sent a letter requesting their assistance, which clearly stated what data was being collected and why it was required (full information and comprehension). Only one e-mail was sent to request participation and responding to this request was completely voluntary.

Consent to participate in the research was implied in one study with the return of the questionnaire (D'Alessandro, Kreiter & Peterson, 2004). This research followed the same principle.

Anonymity of respondents and their responses was guaranteed (Flick, 2006). The data from the clinical librarians and medical librarians were completely anonymised on receipt. No person identifiable data were collected from the online questionnaires.

Data were secured against misuse, loss and unauthorised access (Flick, 2006). The principles of the Data Protection Act 1998 were adhered to in this research (Denscombe, 2003):

- Collect and process data in a fair and lawful manner. In this research, the respondents were fully informed as to the reasons for the data being collected and how they were to be used.
- Use data only for the purposes originally specified. In this research, the e-mail addresses were destroyed so that potential respondents were not contacted to participate in other research. The data collected were only used for this research.
- Collect only the data actually needed. To limit the time respondents spent completing the log and the online questionnaire, only data that would be analysed were collected in this research.
- Take care to ensure data are accurate. The integrity of the data were maintained in this research through limited transference of the data to avoid transcription errors.
- Keep data no longer than necessary. Once the data were analysed and the thesis completed (including the viva) destruction of original data is envisaged.
- Keep the data secure. In this research, the data were kept on the researchers' staff network drive (password protected) and each document was also further password protected.
- Do not distribute the data. The researcher kept control over all the data collected and no original data were distributed.
- Restrict access to the data. The data in this research were only accessible to the author / researcher.
- Keep data anonymous. The data were anonymised on receipt by the researcher.

3.9 Research Techniques - Clinical Librarian's Log, Clinical Questions and Online Questionnaire

3.9.1 Clinical Librarian's Log

This is a quantitative data collection method. The information gathered using this research technique was used to address the information need objective, "to quantify the information needs of doctors".

3.9.1.1 Clinical Librarians

The Clinical Librarian service is user-oriented rather than subject-oriented (Campbell, 1981). The Clinical Librarian (CL) responds to the information needs of the clinical team, so is a "demand-driven" service. Coumou & Meijman (2006) classified the role of the CL as "the Supporter" providing a very specific and time-relevant service.

There is no fixed job description for the role of CL. The environment that the service is established in ultimately influences the job role and duties. The CL can act as an "intermediary, educator and disseminator" (Winning & Beverley, 2003, p.11). To be involved in this research the remit of the CL must include attending meetings, rounds or patient reviews in the clinical setting. This is because this is the area in which the CL will collect the data for this research. The clinical librarians that participated in this research work in the UK were established in the health care teams they supported.

Lis-medical (JISCmail UK medical / health care library community / information workers), clin-lib (JISCmail UK Clinical Librarian mailing list) and attendees of the previous UK Clinical Librarian Conferences (http://www.le.ac.uk/li/lgh/library/confer.htm and http://www.le.ac.uk/li/lgh/library/clconfpage04.htm) were searched to identify potential Clinical Librarians. A database of sixty-five individuals whose job title included clinical librarian was compiled. All were sent an e-mail inviting them to participate in this research. 29% (19) were undeliverable or the respondent no longer undertook the role of clinical librarian and 17 % (11) did not respond. 39% (25) responded that they did not attend ward rounds or clinical meetings, or if they did that their client group were not doctors. Surprisingly, considering the job title, 6% (4) did not answer clinical questions. Only 9% (6) responded that they did attend ward rounds or clinical meetings and of those, 83% (5) agreed to collect data.

3.9.1.2 Data Collection by Clinical Librarians

The researcher ensured that only data needed for the research were collected. The instructions to the clinical librarians were precise. The reasons why they were collecting this information and the plans for the information were clearly explained to the clinical librarians (Bell, 2005).

The clinical librarians collected "factual data", that is a log of things that happened, decisions made and people involved (Denscombe, 2003). In some respects this form of data collection is an observation schedule (Bell, 2005). The data to be collected by the clinical librarians included:

- Date of the clinical meeting or ward round;
- The number of qualified doctors present;
- The total number of patient cases discussed;
- The total number of clinical questions raised;
- The actual question asked.

Data were collected for between four and six months (dependant on the work commitments of the clinical librarians).

This technique overcomes many of the problems raised by employing other data collection methods. For example, observation can influence the behaviour of the participant which is known as the "Hawthorne effect" (Pope & Mays, 1995, p.43). Another data collection method, the questionnaire, relies on the respondent's memory. However, in this research the practical problem of encouraging participants to complete the log "consistently and reliably over a period of time" must be highlighted (Wellington, 2000, p.119).

3.9.1.3 Analysis of Data Collected

The recognised need was determined by calculating the number of questions asked per patient. This was calculated by dividing the number of questions asked by the number of patients discussed. This produced findings that could be compared with research using the same calculations (González- González et al., 2007; McCord et al., 2007; Van Duppen et al., 2007; Ebell & White, 2003; Ramos, Linscheid & Schafer, 2003; and Arroll et al., 2002).

The data were also analysed to determine:

- Doctors' unidentified need - questions identified by clinical librarians, but not by the doctors;
- Information use - questions identified by doctors which the CL was asked to pursue.

3.9.2 Clinical Questions from Medical / Clinical Librarians and from Specific Websites

This is both a quantitative and qualitative data collection method. The information gathered using this research technique was used to answer the information need objective, "to understand the types of information needs of doctors".

The collection of questions from doctors, for which medical librarians search for the evidence in medical databases is a primary source of data (Cohen et al., 2000). Document analysis is used to collect, review and analyse various forms of primary data (O' Leary, 2004).

The major difference between clinical librarians and medical librarians is their work location. Clinical librarians are more likely to be "in the field", working in the "clinical setting" or for a particular clinical team. Medical librarians remain in the library setting where requests for information are sent to them by e-mail, telephone or asked by the doctor in person. Clinical librarian services have previously been thought to be more pro-active, but if medical librarians market themselves effectively, the provision of e-mail means they are more accessible by medical staff.

3.9.2.1 Data Collection by Medical / Clinical Librarians and from Specific Websites

Lis-medical (JISCmail UK medical / health care library community / information workers) and various websites (such as the Scottish Health Information Network, http://www.slainte.org.uk/shineul/SHINEService/MmbrShowMenu.cfm, the Health Libraries Network, http://stlis.thenhs.com/hln/directory/# and WISH, the West Midlands Information Service for Health, http://www.wish-uk.org/directory/directory_home.asp) were searched to identify e-mail addresses for medical librarians. A database of 145 individuals was compiled. All were sent an e-mail inviting them to participate in this research (Appendix III). 20% (29) were undeliverable or the respondent did not find the evidence to clinical questions from doctors and 57 % (92) did not respond. Therefore the response rate was 23%. These 34 information professionals did find the evidence to clinical questions from doctors and agreed to send a sample of questions.

Five websites that hosted questions were used to identify questions. Three were national high-profile sites (ATTRACT, Primary Care Question Answering Service and BestBETs) and two were local sites identified by responses from my e-mail requesting clinical questions (Birmingham Women's Health Centre and Rotherham Primary Care Trust). Since these questions are freely available on the Internet, these questions will be used as examples to illustrate any points raised in the analysis, thereby ensuring anonymity of the questions from other respondents. These websites that hosted questions were:

- ATTRACT - http://www.attract.wales.nhs.uk/
- Birmingham Women's Health Centre - http://www.bwhct.nhs.uk/library-dsq.htm
- BestBETs - http://www.bestbets.org/cgi-bin/browse.pl?~show=title
- Primary Care Question Answering Service - http://www.clinicalanswers.nhs.uk/
- Rotherham Primary Care Trust - http://www.rotherhampct.nhs.uk/knowledgeservice/Enquiries.asp#ClinicalQu

The questions were received from all parts of mainland UK, representing the whole country.

In this research, questions were collected until approximately 1,500 questions were received. To be useful the data had to be in a recognisable question format or the intent of the question had to be transparent.

3.9.2.2 Analysis of Data Collected

Taxonomies are systems of classification used to order and make sense of everyday experiences (Bloor & Wood, 2006). The questions posed by the doctors were analysed to determine if Ely et al.'s (2000) taxonomy derived from family practitioners (office-based) could be applied to hospital doctors and UK general practitioners (primary care). Ely et al.'s (2000) taxonomy is included as Appendix I. The questions were analysed independently by the author and a retired State Registered Nurse (SRN) with over forty years' clinical experience in the acute sector, primary care and community practice. The findings were compared and any differences were discussed and a consensus agreed.

The questions were also analysed to determine if they were foreground or background questions (Cheng, 2004; Green, Ciampi & Ellis, 2000). Background questions are general non-patient specific questions, whilst foreground questions relate directly to a patient.

3.9.3 Questionnaire

This is both a quantitative and qualitative data collection method. In this research, some of the questionnaire questions are qualitative in nature, asking for respondents' views / attitudes towards EBM and awareness / perceived use of online EBM resources. The quantitative questions include the year of medical graduation, average number of times specific questions are formulated and average number of times the literature was searched.

The information gathered from this research technique was utilised to answer several of the research objectives:

<u>Information-Seeking Behaviour</u>

- To understand the preferences of doctors in locating evidence;
- To determine doctors' awareness and use of electronic Evidence Based Medicine resources;
- To rank the perceived barriers for doctors accessing electronic information as an aid in clinical decision making;

<u>Evidence Based Medicine</u>

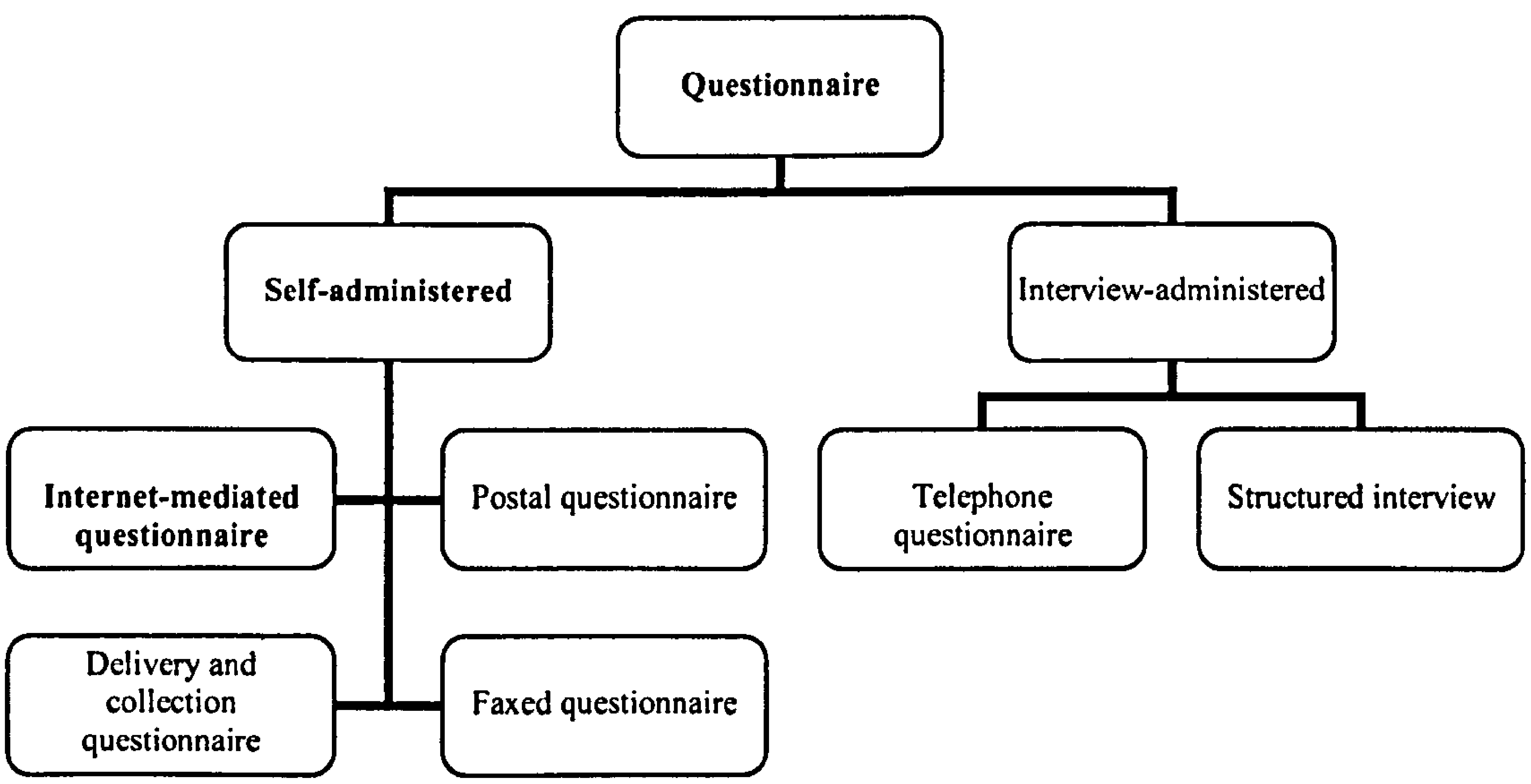
- To identify the attitudes of doctors to Evidence Based Medicine;
- To determine the understanding doctors have of specific Evidence Based Medicine terms.

The questionnaire is an easy research tool to utilise, but an effective design requires time, consideration and an awareness of the information that is being sought.

In this research a questionnaire was utilised as a substitute for observation. Timescales and financial pressures discouraged the physical observation of a significant number of doctors, to determine their electronic resource usage. The only practical solution would have been to monitor the actual usage of resources via the computer. This approach was feasible with the CIAP (Clinical Information Access Program) project in Australia (Westbrook, Gosling & Coiera, 2004). In that research the electronic resources were hosted and monitored from one website. This was not the case with the electronic resources being investigated in this research.

Figure 3.5 illustrates the variety of questionnaire type available, highlighting the style selected for this research.

Figure 3.5: Types of Questionnaire (adapted from Saunders, Lewis & Thornhill, 2007, p.357)



3.9.3.1 Advantages of Questionnaires

Online questionnaires, in particular, offer the advantages of efficiency and low costs.

Questionnaires allow examination of large samples. They are particularly useful with a geographically diverse population. The online questionnaire can be distributed globally literally with the click of a button (the send key for an e-mail).

Respondents can complete the questionnaire at a time and place that is most convenient for them (Gray, 2004). This is a major advantage of this technique in comparison to interviews or focus groups.

Online questionnaires can utilise colour to enhance the presentation of the questionnaire (Bryman, 2004). In this research this feature was utilised to make the questionnaire as appealing as possible to the respondents.

A major advantage of using an online questionnaire is that the data does not need to be transcribed (Saunders, Lewis & Thornhill, 2007). In this research, the completed questionnaire data was downloadable from Survey Monkey into Excel. From there the data was easily transferred into SPSS.

3.9.3.2 Disadvantages of Questionnaires

A self-administered survey may not be the most effective method of collecting data from busy doctors.

The survey length must not be overwhelming otherwise respondents will not waste their time completing it (Cheng, 2004). This therefore limits the number of questions included in the questionnaire research instrument.

Questionnaires are limited by the choice of answers and usually respondents are not given the opportunity to explain their responses. Also, questionnaires cannot probe or prompt respondents (Bryman, 2004). This is a particular issue when asking questions that require judgements or decisions (Marshall, 1992). To overcome that issue, the researcher's e-mail address was included in the promotion of the questionnaire and on the questionnaire itself for respondents to send further information.

There may be a tendency for respondents to make socially acceptable responses, such as understanding (7%) or knowing (10%) a fictitious term (Trelle, 2002). A study by Hancock and Flowers (2001) found no difference in the social desirability responses of students at an American University when they compared surveys administered on the World Wide Web to those on paper. The online questionnaire in this research did not ask for any personally identifiable data to encourage respondents to provide frank, potentially non-socially desirable responses.

Self-assessments are subject to bias (Pluye et al., 2005). Respondents may also over-estimate or under-estimate their skill level or knowledge in an area, due to over-confidence or a lack of self-esteem. There is also no guaranteed method of ensuring that respondents interpret the question in the way the author envisaged. This interpretation is a downside of the questionnaire. In an interview, questions can be restated or explained if the respondent is not really answering the question posed.

This questionnaire asked respondents to assess their understanding of EBM terms, to identify which Medline search features they used and awareness / perceived use of EBM resources. The problem is that respondents may answer with what they think they do, rather than what they actually do. This is not deliberate misleading, but the difference between perception and reality (Upton & Lewis, 1998).

One major disadvantage is that respondents are a self-selected group who are not likely to be representative, especially in the use of information technology and attitudes towards EBM (Wellington, 2000). In this research, the respondents are more likely to be positive towards EBM and electronic resources.

Another major disadvantage with an online questionnaire is the technology itself. Firstly respondents are automatically restricted to those that use computers. However, even those who regularly use computers are still restricted by their computer processor speed and Internet access (speed and reliability). Four comments from respondents illustrate the issues experienced with the technology:

> "there is a problem with q 12 - it won't let you complete it and then tells you, you have missed a q - I tried refreshing the page but no joy" [Dr CP];
> "one question, will not let more than two replies in, no 12, tried reloading, still does not work, if you put tick in line one, then two, it cancels out line one" [Dr RA];
> "Sorry to report q12 isn't working. Disaster strikes" [Dr AW];
> "I tried to do this but it kept seizing up ... sorry" [Dr DB].

There was a noticeable fall in responses between page five, EBM Resources (which hosts question 12) and page six, Views and Attitudes towards EBM. Seventeen fewer responses were recorded, representing 3% of the total responses. The responses received from those who took the time to e-mail suggest that the transition between these pages was not always operational.

3.9.3.3 Development of the Questionnaire Research Instrument

Authors of published research studies in this area kindly e-mailed their questionnaires. These provided a starting point in creating the questionnaire instrument for this research. Other questionnaires were downloaded from the appendices of journal articles. Table 3.1 illustrates which questionnaires were obtained in this research. A total of 266 questions were identified from these eleven questionnaires.

Table 3.1: Authors with the Relevant Article that Provided Questionnaires

Author	Article Title	Journal, Year Published, Volume, Page	Action
<u>Andrews, J.E.</u> et al.	Information-seeking behaviour of practitioners in a primary care practice-based research network (PBRN)	Journal of the Medical Library Association, 2005, 93(2). 206-12	Underlined author sent the link to the online PDF questionnaire
Bennett, N.L. et al., <u>Kristofco, R.</u>	Family physicians' information seeking behaviours: A survey comparison with other specialities	BMC Medical Informatics and Decision Making, 2005, 5(9)	Underlined author e-mailed questionnaire
Cullen, R.J.	In search of evidence: family practitioners' use of the Internet for clinical information	Journal of the Medical Library Association, 2002, 90(4), 370-9	Author e-mailed questionnaire
<u>Doney, L.</u>, Barlow, H., West, J.	Use of libraries and electronic information resources by primary care staff: Outcomes from a survey	Health Information and Libraries Journal, 2005, 22(3), 182-8	Underlined author e-mailed questionnaire
<u>McAlister, F.A.</u> et al.	Evidence-based medicine and the practicing clinician	Journal of General Internal Medicine, 1999, 14(4), 236-42	Underlined author faxed questionnaire
McColl, A. et al.	General practitioners' perceptions of the route to evidence based medicine: A questionnaire survey	British Medical Journal, 1998, 316(31), 361-5	Downloaded questionnaire (eBMJ)

Author	Article Title	Journal, Year Published, Volume, Page	Action
Scott, I., Heyworth, R., Fairweather, P.	The use of evidence-based medicine in the practice of consultant physicians. Results of a questionnaire survey	Australian and New Zealand Journal of Medicine, 2000, 30(3), 319-26	Underlined author e-mailed questionnaire
Sur, R.L. et al.	Evidence based medicine: A survey of American urological association members	The Journal of Urology, 2006, 176(3), 1127-34	Questionnaire included in the article as an Appendix
Veness, M., Rikard-Bell, G., Ward, J.	Views of Australian and New Zealand radiation oncologists and registrars about evidence-based medicine and their access to Internet based sources of evidence	Australasian Radiology, 2003, 47(4), 409-15	Underlined author e-mailed questionnaire
Wilson, P., Glanville, J., Watt, I.	Access to the online evidence base in general practice: A survey of the Northern and Yorkshire region	Health Information and Libraries Journal, 2003, 20(3), 172-8	Underlined author e-mailed questionnaire
Wong, K., Veness, M.J.	Internet access, awareness and utilisation of web-based evidence: A survey of Australian, New Zealand and Singaporean radiation oncology registrars	Asia-Pacific Journal of Clinical Oncology, 2005, 1(4), 120-7	Underlined author e-mailed questionnaire

The 266 questions identified from the questionnaires were divided into the relevant sections of the questionnaire research instrument. Table 3.2 illustrates the breakdown of the questions. Questions that would collect responses to answer the research objectives (outlined in the introduction) were then identified and selected for this research instrument. The categories for frequencies in applicable questions, where possible, were chosen from previous research studies to enable direct comparison.

Table 3.2: Breakdown of Questions by Section

Section	Total Number of Questions	Number of Questions Selected
Demographic data	86	3
Need for information	103	4
Terms and skills used	9	2
EBM resources	38	3
Views and attitudes towards EBM	30	2
TOTAL	266	14

The question on medical specialism was important to ensure a cross-section of doctors responses were received. The list of specialisms on WebMD: Health Topics identified sixty-two different disciplines (http://www.webmd.com/a-to-z-guides/medical-specialists-medical-specialists), but these had a US focus with terms such as medical examiner, rather than the UK term of pathologist. A list of this length would have been off-putting to potential respondents. Therefore to produce the list used in this questionnaire disciplines were compared from those listed in ten hospitals:

- Five of the hospitals from the "Top 40 hospitals" as ranked by CHKS in 2006 (http://www.chks.co.uk/index.php?tophospitals2006) - Doncaster & Bassetlaw Hospitals NHS Foundation Trust (http://www.dbh.nhs.uk/about_us/clinical_services/default.asp, accessed 25th September 2006), Maidstone & Tunbridge Wells NHS Trust (http://www.kentandmedway.nhs.uk/structure_and_organisations/hospital_trusts/maidstone_and_tunbridge_wells_nhs_trust/trust_services.asp, accessed 25th

September 2006), Mid Essex Hospital Services NHS Trust (http://www.meht.nhs.uk/A-Z_Services.htm, accessed 15th September 2006), York Hospitals NHS Trust (http://www.yorkhealthservices.org/services/services.php3, accessed 25th September 2006) and The Newcastle upon Tyne Hospitals NHS Foundation Trust (http://www.newcastle-hospitals.org.uk/directorates, accessed 27th September 2006);

- Three local hospitals were included - UHL - University Hospitals of Leicester NHS Trust (http://www.uhl-tr.nhs.uk/our-services/medical-services, accessed 14th September 2006), Nottingham University Hospitals NHS Trust (http://www.nuh.nhs.uk/qmc/Services/Services.htm and http://www.nuh.nhs.uk/nch/servicelist.html, accessed 15th September 2006) and Sheffield Teaching Hospitals NHS Foundation Trust (http://www.sth.nhs.uk/about/1-4.php, accessed 14th September 2006);
- Two of the major London hospitals, Guy's and St Thomas' NHS Foundation Trust (http://www.guysandstthomas.nhs.uk/services/ourservices.aspx, accessed 14th September 2006) and Barts and The London NHS Trust (http://www.bartsandthelondon.org.uk/ourspecialties/atoz.asp?l=all, accessed 15th September 2006).

A word version of the online questionnaire is included as Appendix IV.

3.9.3.4 Types of Question

Questionnaires can utilise several types of questions (McColl et al., 1998):

- Visual analogue scales which can be used to gather information on views and attitudes.

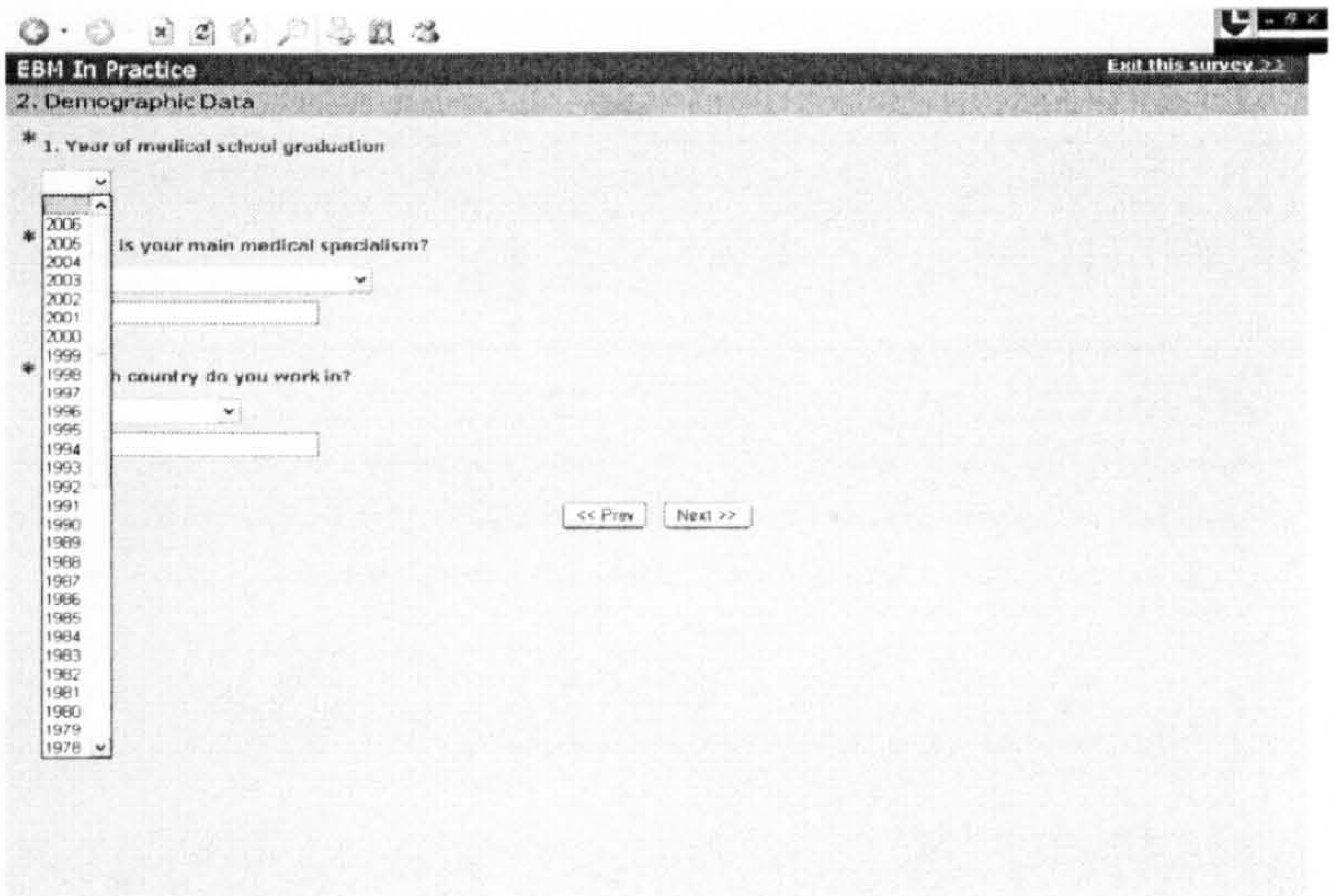
- Closed questions that are specifically designed to gather quantitative data. For example, in this research, the year of medical school graduation. Closed questions are quick and easy for respondents to complete and for the researcher are easy to analyse (Bryman, 2004). However, respondents may feel the options provided are not suitable (Bryman, 2004). This was illustrated in this research, as two respondents e-mailed:

  > "At least one question used the "frequency" terms "sometimes" and "never" without qualification - I had some problem with 'sometimes' if this meant just once 5 years previously" [Dr IP];
  > "A little hard to fill in as no "frequently" category" [Dr NW].

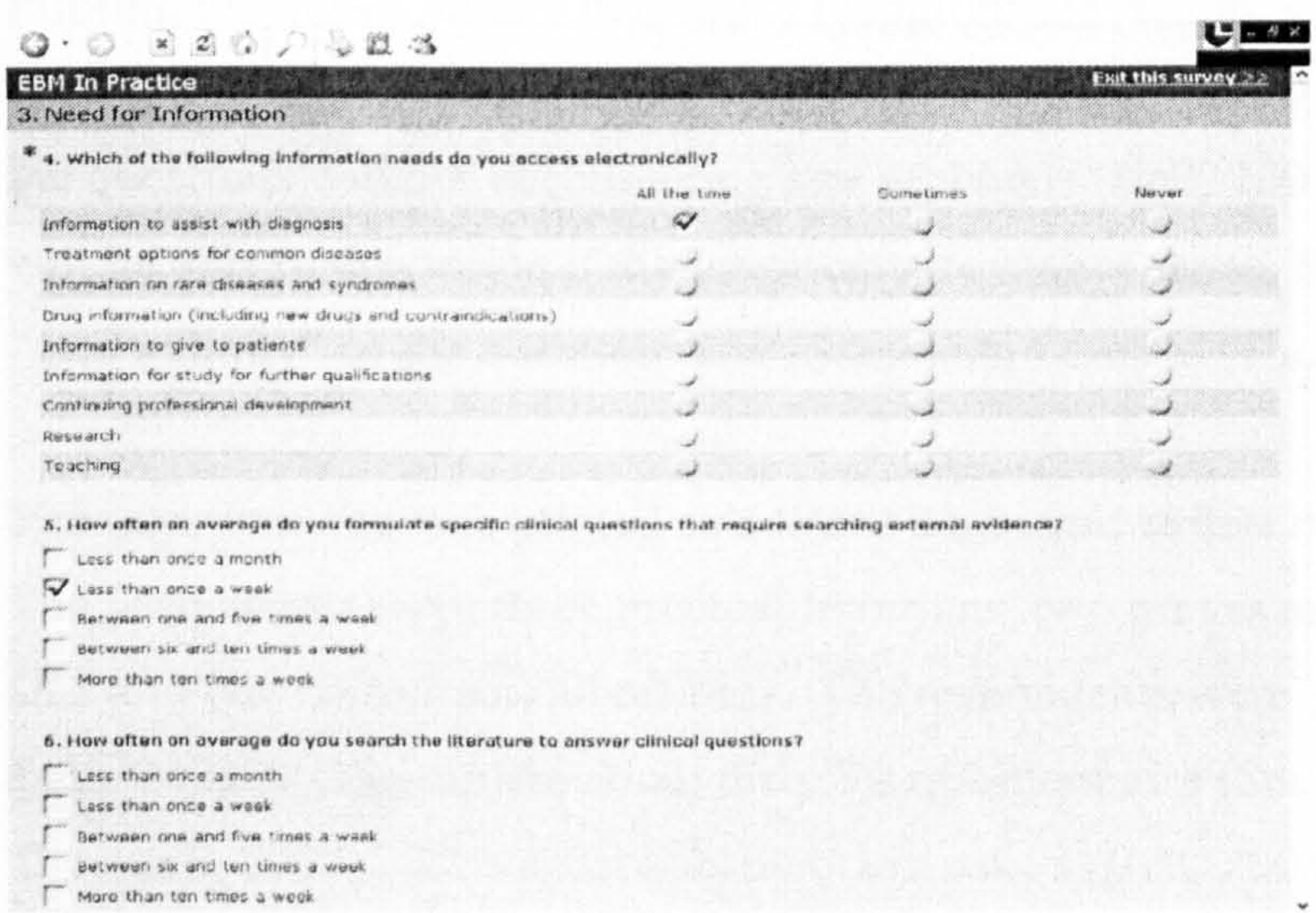
It is important to ensure that the questions posed offer no bias and limit the opportunity for exaggeration. For example instead of asking if the individual is a registrar or consultant, the non-loaded question is "What is the correct title of your job?" (Jones, 1992, p.227).

The online questionnaire provider utilised in this research, Survey Monkey (http://www.surveymonkey.com), supported a variety of question type, including, multiple choice, rating scales and drop-down menus. This research utilised several different types, as illustrated in the following examples.

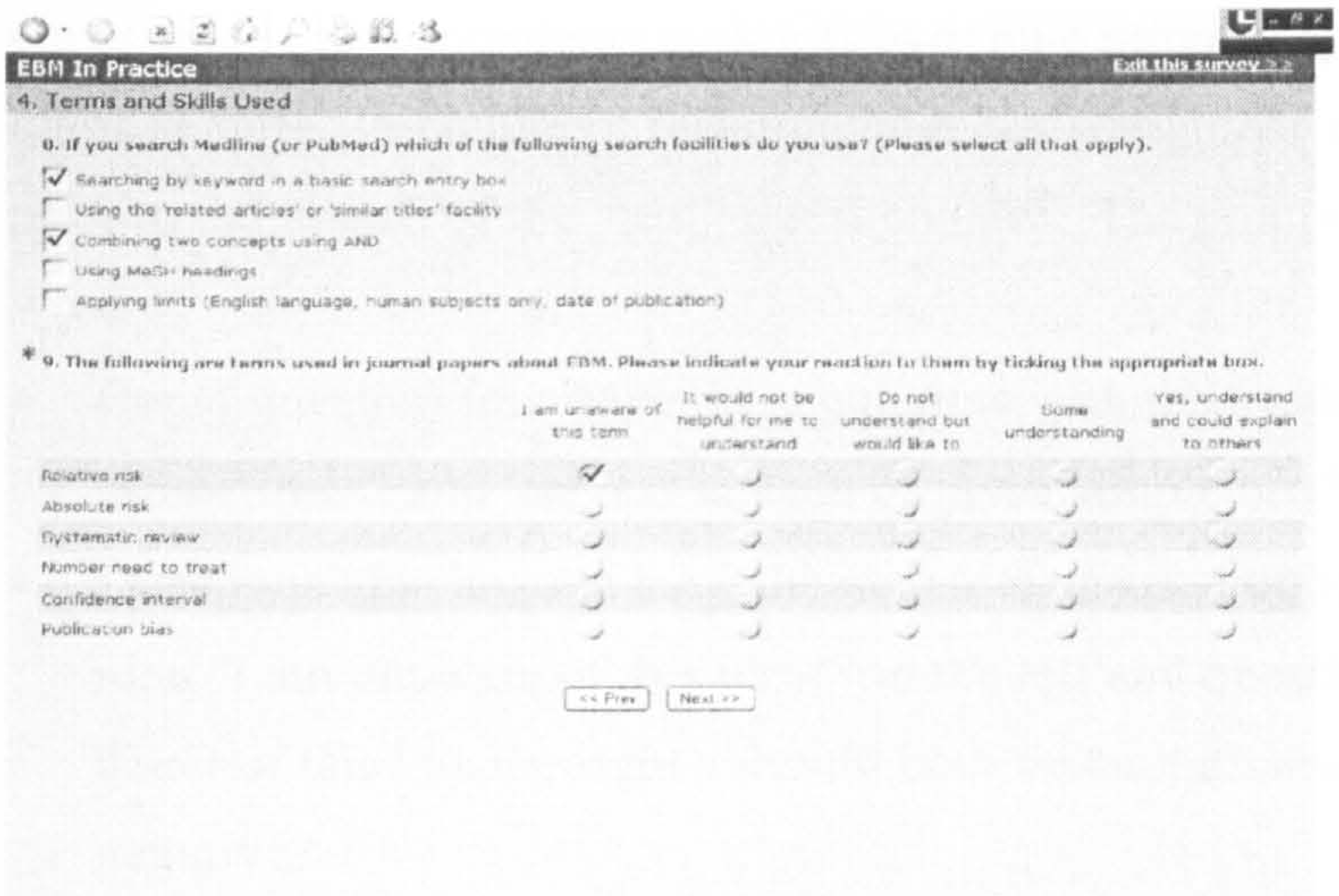
The first question on page 2 (Demographic Data) illustrates a drop-down menu (illustrated on the next page). The two questions below are also drop-down menus, but with a "comment" box entitled "other" for the respondent to enter their own response if none of those provided are suitable.



On the page below, page 3 (Need for Information) two different question types are shown. Question 4 is a "matrix of choices" but only allows one answer per row. Questions 5 and 6 are "multiple choice" allowing only one answer.



On the illustration from Survey Monkey over page, page 4 (Terms and Skills Used) is an illustration of a "multiple choice" question which allows multiple answers (question 8).



3.9.3.5 Piloting the Questionnaire

Piloting the questionnaire highlights inappropriate jargon, poor questions and ambiguity. The aim of the pilot was to ensure that respondents are able to answer the questions without encountering any problems (Bell, 2005). Even "lay" people will be able to determine if the questionnaire makes sense, that is to ensure the "face validity" of the questionnaire (Saunders, Lewis & Thornhill, 2007, p.386).

The questionnaire was piloted as a Word document before the URL was released. The participants were three medical librarians, two nurses and three doctors (two GPs and one consultant; all retired). The respondents were given a short questionnaire to complete about the pilot questionnaire (Saunders, Lewis & Thornhill, 2007). This short questionnaire asked (Bell, 2005):

- How long the questionnaire took to complete?
- Which, if any, questions were unclear or unambiguous?
- Any other comments?

On average the respondents took just over nine minutes to complete the questionnaire. A couple of recommendations were made that were implemented prior to the launch of the "real" questionnaire. The points raised and addressed were:

- Could question four have three columns with the headings "all the time", "sometimes" and "never" instead of just a simple box?
- Questions nine and ten have the negative terms at opposite ends – question nine "I am unaware of this term" on the left and question ten " I have never heard of this" on the right - should both be on the same side as they are both negative?

3.9.3.6 The Online Questionnaire

The online questionnaire is aimed at a population that is computer-literate, able to access e-mails and the Internet (Saunders, Lewis & Thornhill, 2007).

Survey Monkey (http://www.surveymonkey.com/) hosted the online questionnaire for a nominal monthly charge. The survey was designed to enable completion in approximately ten minutes.

3.9.3.7 Promotion and Dissemination of the Questionnaire

Potential participants were e-mailed directly with a link to the questionnaire. Appendix V illustrates the content of the e-mail. The e-mails promoting the questionnaire and requesting completion of the questionnaire contained no attachments. This is due to the issue of attachments containing viruses (Saunders, Lewis & Thornhill, 2007). E-mails that arrive unsolicited and which contain attachments are likely to be deleted unopened due to the potential threat of viruses. Since the main method for contacting doctors regarding the questionnaire was by e-mail to individual (i.e. personal) e-mail addresses, there is a high level of confidence that the relevant person responded (Saunders, Lewis & Thornhill, 2007).

The Royal Colleges and BMA were approached for assistance in promoting the questionnaire URL. This resulted in two Royal Colleges (Royal College of Ophthalmologists and the Royal College of Pathologists) from fourteen and five British Associations / Societies (British Geriatric Society, British Nuclear Medicine Society, British Association of Audiological Physicians, British Society for Haematology and British Society for Immunology) from twenty-two agreeing to promote the URL on the website or electronic newsletters. The problem with this approach is that the potential respondents have to visit the website or be regular readers of the electronic newsletter to become aware of the questionnaire (Shehan & Hoy, 2004).

The Internet was searched to locate the e-mail addresses for doctors. Certain sites listed contact details, such as BAPRAS, the British Association of Plastic, Reconstructive and Aesthetic Surgeons (http://www.bapras.org.uk/), Expert Search (http://www.expertsearch.co.uk/), BUPA Hospitals (http://www.bupahospitals.co.uk/) and CTSNet, the Cardiothoracic Surgery Network (http://www.ctsnet.org/). Academic institutions, such as the Warwick Medical School (http://www2.warwick.ac.uk/fac/med/) and the University of Leicester, Department of Health Sciences (http://www2.le.ac.uk/departments/health-sciences) were also utilised to locate e-mail contact details. The online 2005 BMJ (http://www.bmj.com/) and online studentBMJ (http://www.studentbmj.com/) for 2005 and 2006 were searched for contact details from the journal articles (authors) and letters. General practitioners' e-mails were identified from a list of all NHS Primary Care Trusts at http://www.nhs.uk/england/authoritiestrusts/pct/list.aspx.

There was no method for determining who had responded to the e-mails as the questionnaires were anonymous. This also meant there was no opportunity to send out second follow-up e-mails (Saunders, Lewis & Thornhill, 2007).

One issue was the number of messages that were not deliverable. Overall 25% (733) of the e-mails sent were not delivered. In some cases, this was quite a high percentage. For example, 59% of those send to palliative care doctors were undeliverable and 34% of those sent to general practitioners.

3.9.3.8 Response Rates

Typically response rates from questionnaires are in the range of 10% to 35% (Falconer & Hodgett, 1999). Saunders, Lewis & Thornhill (2007) suggest that the likely response rate using the Internet is 11% or lower. However, doctors are notorious for not completing questionnaires. A response from the British Geriatrics Society requesting they promote the questionnaire URL produced the following comment (Atkins, 2006);

> "I should warn you that doctors are not hot on filling in online surveys (or any surveys at all, for that matter). Generally, we have to do a multi-pronged approach including mailing out paper survey forms and exhorting them to respond several times before we get a 20% response....and that is on subjects of direct relevance to them."

The response rate for this questionnaire in this research is hard to determine exactly since three organisations sent out the link in an electronic newsletter and four hosted the questionnaire link on a web page. Also the BMJ was used to identify possible e-mail addresses, and there is no way to identify if any of these responded. However, there were in total 2351 e-mails delivered, representing 75% of those sent. 636 questionnaires were completed, representing an approximate response rate of 27%. One respondent, Dr AH, sent an e-mail with "it would be interesting to ask if respondents would have done this if sent in paper form. Personally, probably not. Lovely questionnaire, easy to complete". The fact that this questionnaire was online and utilised the display features enabled by such an environment may have been an encouragement for doctors to respond to this survey.

3.9.3.9 Reasons for Low Response Rate

Reasons for not responding to questionnaires include (Falconer & Hodgett, 1999):

- Lack of time;
- Not applicable to the organisation;

- Not a high priority;
- Not interested in surveys;
- Organisational constraints;
- Length of the survey.

In this particular situation, there are specific reasons why individuals may not have responded to the questionnaire:

- "Questionnaire response fatigue". Doctors complete many questionnaires, especially those from their particular Royal College;
- Potential respondents not being aware of the existence of the questionnaire. Few of the Royal Colleges or British Associations were willing to promote the questionnaire to their members, thus raising awareness of the questionnaire. The Royal College of General Practitioners response to the e-mail sent was (Towndrow, 2006):

  > "The College receives a large number of requests of this nature and we regret we are unable to put forward members' names for the research projects conducted by individual researchers or students";
- Contact details for doctors were located via the Internet. But this "hit and miss" strategy missed many potential respondents;
- Time is an obvious issue. The questionnaire was kept as short as possible, but still required up to ten minutes to complete;
- There was no incentive or reward to encourage responses;
- The relevance of this research to respondents is not clear. Whilst the findings may prove interesting, the research was not funded by an organisation able to respond to the results;
- It is likely that only those interested (positively or negatively) in Evidence Based Medicine and/or electronic resources would complete the questionnaire;
- Using an online questionnaire immediately restricts the potential responses. A response from the secretary of a doctor e-mailed illustrates this point, "Many apologies, Dr G does not use the computer at all" [Ms M].

3.9.3.10 Analysis of Data Collected

In the results the data were analysed and where suitable the findings were graphically presented using Excel. Further analysis of the data was undertaken, by comparing responses from GPs and acute-sector doctors and comparing results according to the number of years since medical school graduation.

The total responses provide responses from all medical professionals, without differentiating between work sectors, namely primary and secondary. This provided the complete picture, but may conceal differences between responses from doctors in these two sectors.

Comparing responses from GPs and acute-sector doctors overcomes the limitations of the "total responses". However the acute sector doctors are considered as an homogenous group, whereas the many medical specialisms based in hospital settings are numerous and very different. Therefore, the "acute-sector" results are an amalgamation of different specialisms responses, which may again conceal differences in findings.

Comparing results according to the number of years since medical school graduation should demonstrate whether doctors who graduated more recently used computers more regularly. Doctors in this research were relatively experienced with an average twenty-one years since medical school graduation. It would be anticipated that these doctors would be less likely to embrace technology, such as computers, as their medical school training was pre-desk-top computing. However, the fact that they maintained an e-mail address and were technically proficient enough to access and complete the questionnaire suggested that the respondents were not technophobes. This method of data collection fails to consider those doctors who do not utilise computers and by default electronic resources.

3.10 Study Limitations

The analysis of the questions from doctors utilising the taxonomy created by Ely et al., (2000) was undertaken by two researchers. The validity and reliability of the analysis in this research would have been improved with more researchers analysing the same data. In the study by Ely et al. (2000) seven "investigators" evaluated questions to arrive at consensus decisions, whilst in this research only the author and one other (an experienced qualified nurse) evaluated the questions.

The method of recruiting volunteers to complete the online questionnaire potentially skewed the results towards those likely to have positive attitudes towards EBM and IT. This is because potential respondents were required to have an active e-mail address (on a website) or have authored a journal article (or written a letter in response to an article). To be "neutral" the questionnaire should have been sent to NHS Trusts e-mail lists (of doctors), but there data were not readily available.

Identifying volunteers to complete the online questionnaire by using authors' e-mail addresses from journal articles in the British Medical Journal has the potential of recruiting doctors involved in post-qualification academic study. This again may skew the results (towards positive attitudes towards EBM and IT) as these doctors may be more amenable to developing new skills to keep up-to-date to ensure students receive the most relevant learning experience. This does not mean that other doctors do not keep up-to-date, but other pressures, such as a larger patient caseload may impact on their time to develop EBM and IT skills.

The questionnaire gathered doctors' perceptions of their search skills and the resources they believe they utilised to locate the evidence for patient care. Previous research has shown that perceptions may not be the same as reality (Covell, Uman & Manning, 1985). This research did not investigate doctors' actual practical searching skills and the actual use of information was not considered or evaluated.

4 Results

The results chapter analyses the data collected by the method of collection, namely, the clinical librarian's log; questions collected by medical librarians, clinical librarians and from specific websites; and the online questionnaire.

4.1 Clinical Librarian's Log

The first element in this section is to determine whether doctors have an information need, and if they do to quantify that need. In this research, that investigation was undertaken by five clinical librarians keeping logs of their clinical meetings and ward rounds (as outlined in the research techniques section of the Methodology chapter). Table 4.1 shows the totals from the data collected over the six months by these Clinical Librarians.

Table 4.1: Data Collected from Clinical Librarians' Logs

Number of qualified doctors present	Total number of patient cases discussed	Total number of clinical questions raised	Questions asked that the Clinical Librarian pursed an answer to	Questions identified and pursued by the Clinical Librarian
655	1210	286	63	17

4.1.1 Identified Need

This is the most obvious need, the articulated or recognised need (Lor, 1979).

Previous research has determined the number of questions asked per patient. This was calculated by dividing the number of questions asked by the number of patients discussed. The same technique was utilised in this research.

Questions asked per patient case discussed were 286 divided by 1210 which equals 0.24 or approximately one question for every four patients.

Questions asked per doctor were 286 divided by 655 representing 0.44 or nearly one question for every two doctors.

4.1.2 Unidentified Need

Unperceived needs are not recognised as information needs and so answers are not pursued (Buckland, 1988). In other words, the doctor is unaware there is a gap in his/her knowledge, the need is unidentified.

This research categorizes the unidentified need as those questions identified by clinical librarians, but not specifically identified by the doctors themselves. These may rise from discussions between the doctors themselves or be questioning points raised that the doctors do not actually identify as questions.

Previous research has not determined the number of questions asked per doctor. However, this research calculated this by dividing the number of questions identified by the Clinical Librarians by the number of doctors present.

Questions asked per doctor were 17 divided by 655, which equals 0.03 or one question for every thirty-eight doctors. In the UK, there are currently 238,676 doctors registered (Fricker, 2007b), who, based on this research, could potentially generate 6,280 questions.

Questions asked per patient case were 17 divided by 1210, representing 0.01 or one question for every 100 patients.

4.1.3 Information Use

Information use refers to what is actually used, or a satisfied need (Line, 1974).

This is a question that has been identified by the doctor. The question was considered of such importance that the clinical librarian was asked by the medical team to follow up on it and locate suitable evidence for their consideration.

Information use per doctor were 63 divided by 655 which equal 0.10 or one question for every ten doctors.

Information use per patient were 63 divided by 1210 representing 0.05 or one question for every twenty patients.

4.2 Data Collection by Medical Librarians, Clinical Librarians and from Specific Websites

Two JISCmail groups and various websites were searched to identify e-mail addresses for medical/clinical librarians. These individuals were contacted to determine if they found evidence to clinical questions from doctors and if so, would they be willing to send a sample of questions. Five websites that hosted questions were also used. From this a total of 1,633 clinical questions were collected, 1,093 from the acute-sector and 540 from GPs.

The Ely et al. taxonomy (2000) provided a framework to categorise the clinical questions. The taxonomy was utilised in this research to analyse the information needs of doctors in the UK.

4.2.1 Analysis of UK Doctors' Questions

The top ten types of questions asked by doctors in the UK were:

1. How should I treat finding/condition y given situation z? – 17.3% (283);
2. Is drug x indicated in situation y or for condition y? - 14.6% (239);
3. How should I manage condition/finding/situation y? – 8.2% (134);
4. I need to learn more about topic x. - 4.5% (74);
5. Is test x indicated in situation y? - 4.5% (73);
6. What are the manifestations (findings) of condition y? - 3.6% (58);
7. Is x a risk factor for condition y? - 3.3% (54);
8. What is the usual course (or natural history) of condition y? - 3.2% (52);
9. Could finding y be caused by drug x? - 3.2% (52);
10. What is the cause of symptom x? - 3.1% (51).

The top three questions accounted for 40.1% of doctors' information needs. These three questions focus on the treatment/management of patients with pre-existing conditions or in specific situations. This illustrates that the practice of medicine occurs in the "real world" as people often suffer from a variety of conditions that may interrelate with each other and also impact on treatment regimes.

Analysing the questions identified ten additional categories to those originally classified by Ely et al. (2000). These were:

- 2.2.5.1 (treatment - not limited - adverse effects – findings); one of the two information requests from an acute-sector doctor was "Adverse effects of therapeutic Hyperoxia".
- 2.2.5.2 (treatment - not limited - adverse effects – safety); for example a GP question was "Are there any contraindications for using oxygen in a patient diagnosed with heart failure?"

- 2.2.7.1 (treatment - not limited – cost); one such information request from an acute-sector doctor was "Cost effectiveness of the diabetes prevention programme."
- 3.3.4.1 (management - doctor-patient - views / attitudes); for example an acute-based doctor requested information on "Medical staff attitudes towards family members being present in resuscitation."
- 3.3.5.1 (management - doctor-doctor - how to do it); an example question from an acute-sector doctor was "Correspondence/letters from Consultants in Learning Disability or Consultants Psychiatry back to GPs - accuracy?"
- 3.3.6.1 (management – screening); for example an information request from an acute-based doctor was "Screening in the UK for Chlamydia or other STIs (Sexually Transmitted Infections)".
- 5.7.1.1 (non-clinical – ethnicity); an example question from an acute-sector doctor was "In labouring pregnant women, does afro Caribbean race affect the cervimetric progress of labour?"
- 5.8.1.1 (non-clinical - religion / culture); one such information request from a GP was "Cultural considerations in prescribing medication"
- 5.9.1.1 (non-clinical - statistics); an example question from a GP was "Can you tell me if there is any information showing percentage drop out rates for weight management groups in this country?"
- 5.10.1.1 (non-clinical - IT / Internet); for example one GP asked for information on "Internet access policies."

4.2.2 General Comparison of UK GPs and UK Acute Sector Doctors' Questions

The questions were analysed to determine if they were foreground or background questions (Cheng, 2004; Green, Ciampi & Ellis, 2000). Background questions are general non-patient specific questions, whilst foreground questions relate directly to a patient. Table 4.2 compares the results from the acute-sector doctors to the GPs.

Table 4.2: Comparison of Foreground and Background Questions from Acute-Sector Doctors and GPs

	Acute Sector Doctors	GPs
Foreground	62.2%	56.1%
Background	37.8%	43.9%

The Pearson Chi-Square p value is 0.157. Therefore there is no significant difference in doctor's work sector. The results show a 3:2 ratio for foreground to background questions. For every ten questions posed by doctors, six relate directly to a patient. The other four questions may relate to patient care in general, but not to a specific case.

Table 4.3: Comparison of Types of Questions from Acute-Sector Doctors and GPs

	Acute Sector Doctors	GPs
Diagnosis	20.5%	14.3%
Treatment	48.7%	53.3%
Management	12.4%	16.3%
Epidemiology	10.3%	5.4%
Non-clinical	8.1%	10.7%

Table 4.3 compares the types of questions from acute-sector doctors to GPs. The top category for both groups was treatment. However acute-sector doctors then asked diagnosis questions followed by management, whilst GPs asked management questions followed by diagnosis. Double the numbers of epidemiology questions were asked by acute-sector doctors compared to GPs.

The ratio of treatment to diagnosis questions is different. Acute-sector doctors ask roughly 1:2 (1 diagnosis for every two treatment) compared to GPs who ask nearly 1:4 (1 diagnosis for every four treatment questions).

4.2.3 In-depth Comparison of UK GPs and UK Acute Sector Doctors Questions

Analysis of the results from the clinical questions when compared between the UK General Practitioners and Acute-sector based doctors does produce different results in certain categories. These are illustrated in the following Tables, 4.4 to 4.8.

Table 4.4: Comparison of Acute-sector Doctors and GPs Diagnosis Questions

Code	Primary	Tertiary / Quaternary	Acute % Number	GP % Number
1.1.1.1	Diagnosis	Cause / Symptom	3.6% 39	2.2% 12
1.1.2.1	Diagnosis	Cause / Sign	2.3% 25	1.9% 10
1.1.3.1	Diagnosis	Cause / Test Finding	0.2% 2	0.2% 1
1.1.4.1	Diagnosis	Cause / Unspecified Findings	0% 0	0% 0
1.2.1.1	Diagnosis	Criteria	4.2% 46	2.2% 12
1.3.1.1	Diagnosis	Test / Indications	5.5% 60	2.4% 13
1.3.2.1	Diagnosis	Test / Accuracy	3.1% 34	2.6% 14
1.3.3.1	Diagnosis	Test / Timing	0.2% 2	1.5% 8
1.3.4.1	Diagnosis	Test / Preparation	0.2% 2	0% 0

1.3.5.1	Diagnosis	Test / Method	0.8% 9	0.9% 5
1.4.1.1	Diagnosis	Name Finding / Body Part	0% 0	0% 0
1.4.2.1	Diagnosis	Name Finding / Condition	0% 0	0% 0
1.4.3.1	Diagnosis	Name Finding / Test	0% 0	0% 0
1.5.1.1	Diagnosis	Orientation / Condition	0% 0	0% 0
1.5.2.1	Diagnosis	Orientation / Test	0.4% 4	0.2% 1
1.6.1.1	Diagnosis	Inconsistencies	0.1% 1	0% 0
1.7.1.1	Diagnosis	Cost	0% 0	0.2% 1
1.8.1.1	Diagnosis	Not Classified Elsewhere	0% 0	0% 0

The top two categories for acute-based doctors were:

1. 1.3.1.1 (test – indications). An example of an information request in this category was "The use of CRP in diagnosing infection in surgery".
2. 1.2.1.1 (criteria). An information need identified in this category was "Toxic Shock Syndrome in children associated with burns."

The top two categories for GPs were:

1. 1.3.2.1 (test – accuracy). An example question was "Which is the best standardised assessment to measure fear of falling in older people who have fallen?"
2. 1.3.1.1 (test – indications). An example question in this category was "If I wished to test a patient's Thyroid Function tests (TSH/T4) should the test be postponed until the patient is fully recovered from illness?"

Acute-based doctors asked more questions in the 1.2.1.1 (criteria) category whilst more GPs asked questions on 1.3.2.1 (accuracy).

Two categories had no GP questions;

- 1.3.4.1 (test – preparation). One of the two acute questions posed was "In patients with PET what volume of urine is required to determine adequate renal function?"
- 1.6.1.1 (inconsistencies). The one acute question was "Does nicotine replacement affect bone healing?"

One category, 1.7.1.1 (cost) had no acute-sector doctor questions. The one GP question posed was "What are the costs of the antigen test for H. pylori?"

Table 4.5: Comparison of Acute-sector Doctors and GPs Treatment Questions

Code	Primary	Tertiary / Quaternary	Acute % Number	GP % Number
2.1.1.1	Treatment	Drug Prescribing / How to Prescribe / Undifferentiated	0.8% 9	1.1% 6
2.1.1.2	Treatment	Drug Prescribing / How to Prescribe / Dosage	0.5% 5	2% 11
2.1.1.3	Treatment	Drug Prescribing / How to Prescribe / Timing	0.8% 9	4.1% 22
2.1.2.1	Treatment	Drug Prescribing / Drug of Choice / Treatment	16.2% 177	11.5% 62
2.1.2.2	Treatment	Drug Prescribing / Drug of Choice / Prevention	1.8% 20	3.2% 17
2.1.3.1	Treatment	Drug Prescribing / Adverse Effects / Findings	2.6% 28	4.5% 24
2.1.3.2	Treatment	Drug Prescribing / Adverse Effects / Administration	0.7% 8	0.2% 1
2.1.3.3	Treatment	Drug Prescribing / Adverse Effects / Safety	0.5% 5	4.3% 23
2.1.4.1	Treatment	Drug Prescribing / Interactions	0.3% 3	1.7% 9

2.1.5.1	Treatment	Drug Prescribing / Name Finding	0% 0	0% 0
2.1.6.1	Treatment	Drug Prescribing / Orientation	0.3% 3	1.3% 7
2.1.7.1	Treatment	Drug Prescribing / Physical Characteristics	0% 0	0.6% 3
2.1.8.1	Treatment	Drug Prescribing / Pharmaco-Dynamics	0.2% 2	0.2% 1
2.1.9.1	Treatment	Drug Prescribing / Mechanism of Action	0.1% 1	1.1% 6
2.1.10.1	Treatment	Drug Prescribing / Cost	0.4% 4	0.2% 1
2.1.11.1	Treatment	Drug Prescribing / Serum Levels	0% 0	0% 0
2.1.12.1	Treatment	Drug Prescribing / Availability	0% 0	0.6% 3
2.2.1.1	Treatment	Not Limited to but May Include Drug Prescribing / Efficacy / Treatment	19.5% 213	13% 70
2.2.1.2	Treatment	Not Limited to but May Include Drug Prescribing / Efficacy / Prevention	0.5% 5	0.6% 3
2.2.2.1	Treatment	Not Limited to but May Include Drug Prescribing / Timing	0.9% 10	0.6% 3
2.2.3.1	Treatment	Not Limited to but May Include Drug Prescribing / How to Do It	1.6% 17	1.1% 6
2.2.4.1	Treatment	Not Limited to but May Include Drug Prescribing / Principles	0.2% 2	0.4% 2

2.2.5.1	Treatment	Not Limited to but May Include Drug Prescribing / Adverse Effects / Findings	0.2% 2	0.2% 1
2.2.5.2	Treatment	Not Limited to but May Include Drug Prescribing / Adverse Effects / Safety	0.5% 5	1.1% 6
2.2.7.1	Treatment	Not Limited to but May Include Drug Prescribing / Cost	0.4% 4	0.2% 1
2.3.1.1	Treatment	Not Classified Elsewhere	0% 0	0% 0

The top two categories for acute-based doctors were:

1. 2.2.1.1 (not limited – treatment). An example of an information request in this category was "Use of functional electrical stimulation (FES) for patients with spinal cord or nerve injuries".
2. 2.1.2.1 (drug prescribing – treatment). An example question was "What is the efficacy of Sertraline in old age depression?"

The top two categories for GPs were the same:

1. 2.2.1.1 (not limited – treatment). An example of an information need for this category was "Effectiveness of surgery for whiplash injury".
2. 2.1.2.1 (drug prescribing – treatment). An example question in this category was "In a patient with a history of angina, who has been asymptomatic since the insertion of a stent, is there any benefit in starting him on a B blocker?"

This illustrates that the majority of the treatment questions focus on the efficacy of treatments, whether pharmaceutical or "not limited to drug prescribing".

Two categories had no acute-sector doctor questions, compared to questions from GPs:

- 2.1.7.1 (drug prescribing – physical characteristics). A GP question asked was "I have a patient with high blood pressure who is unable to swallow tablets however he is able to chew. Which medications would he be able to take?"

- 2.1.12.1 (drug prescribing – availability). The one GP question posed was "Is Zestra available in the UK?"

Table 4.6: Comparison of Acute-sector Doctors and GPs Management Questions

Code	Primary	Tertiary / Quaternary	Acute % Number	GP % Number
3.1.1.1	Management	Condition	7.9% 86	8.9% 48
3.2.1.1	Management	Other Providers / Practices of Other Providers	1.9% 21	2.6% 14
3.2.2.1	Management	Other Providers / Referral	0.2% 2	0.6% 3
3.2.3.1	Management	Other Providers / Community Services	0.4% 4	0.6% 3
3.3.1.1	Management	Doctor-Patient Communication / How to Advise	0.5% 6	1.7% 9
3.3.2.1	Management	Doctor-Patient Communication / How to Approach Difficult Issue	0.3% 3	0.4% 2
3.3.3.1	Management	Doctor-Patient Communication / Patient Compliance	0% 0	0.4% 2
3.3.4.1	Management	Doctor-Patient Communication / Views and Attitudes	0.5% 6	0.2% 1
3.3.5.1	Management	Doctor-Doctor Communication / How to Do It	0.3% 3	0% 0
3.3.6.1	Management	Screening	0.4% 4	1.1% 6
3.4.1.1	Management	Not Classified Elsewhere	0% 0	0% 0

The top category for acute-based doctors was 3.1.1.1 (condition). An example of an information request in this category was "Current practice and management of amblyopia in the UK". The same category was top for GPs. A GP question asked was "A patient aged 23 yrs (never had TB/BCG in UK as child) with no medical history recently returned from Kenya where he worked in an orphanage (and was told there were children with active TB). He has developed no symptoms himself since return. What should be done if he plans to return to Kenya to work?"

One category had no GP questions, compared to questions from the acute-based doctors. An example of a question in this category, 3.3.5.1 (doctor-doctor communication / how to do it) was "Letters from Consultants in Psychiatry back to GPs. Do services users and carers want to be copied into the correspondence?"

One category with no acute-sector doctor questions was 3.3.3.1 (doctor-patient communication – patient compliance). One of the two GP questions posed was "Why are patients reluctant to attend for health promotion activities, such as cervical smears, blood pressure checks, asthma clinics?"

Table 4.7: Comparison of Acute-sector Doctors and GPs Epidemiology Questions

Code	Primary	Tertiary / Quaternary	Acute % Number	GP % Number
4.1.1.1	Epidemiology	Prevalence	2.7% 29	0.9% 5
4.2.1.1	Epidemiology	Aetiology / Causation / Risk Factors	3.7% 40	2.6% 14
4.2.1.2	Epidemiology	Aetiology / Causation / Genetics	0.2% 2	0% 0
4.3.1.1	Epidemiology	Course	3.8% 42	1.9% 10
4.4.1.1	Epidemiology	Not Classified Elsewhere	0% 0	0% 0

The top category for acute-based doctors was 4.3.1.1 (course). An example of a question posed was "What are the neurological complications of cocliac disease?"

The top category for GPs was 4.2.1.1 (aetiology – causation – risk factors) and a question posed was "In men with first episode UTI (Urinary Tract Infection) is prostate cancer more common?"

One category with no GP questions (compared to acute-based doctors) was 4.2.1.2 (aetiology – causation – genetics). One of the two acute questions in this category was "What are the genetic factors that impact on the incidence of myocardial infarction in the South Asian population of Great Britain?"

Table 4.8: Comparison of Acute-sector Doctors and GPs Non-Clinical Questions

Code	Primary	Tertiary / Quaternary	Acute % Number	GP % Number
5.1.1.1	Non Clinical	Education / Provider / Continuing Medical Education	5.1% 56	3.3% 18
5.1.1.2	Non Clinical	Education / Provider / Information Source	0.9% 10	1.3% 7
5.1.1.3	Non Clinical	Education / Provider / Trainee	0.7% 8	1.5% 8
5.1.2.1	Non Clinical	Education / Patient	0% 0	0.6% 3
5.2.1.1	Non Clinical	Administration	0.2% 2	1.5% 8
5.3.1.1	Non Clinical	Ethics	0.5% 6	0.6% 3
5.4.1.1	Non Clinical	Legal	0.1% 1	0% 0
5.5.1.1	Non Clinical	Frustration	0% 0	0% 0

5.6.1.1	Non Clinical	Not Classified Elsewhere	0% 0	0% 0
5.7.1.1	Non Clinical	Ethnicity	0.5% 5	0.6% 3
5.8.1.1	Non Clinical	Religion or Culture	0% 0	0.4% 2
5.9.1.1	Non Clinical	Statistics	0.1% 1	0.4% 2
5.10.1.1	Non Clinical	IT or Internet	0% 0	0.7% 4

The top three categories for acute-based doctors were:

1. 5.1.1.1 (provider – continuing medical education) - An example of an information request in this category was "Background information on the following condition - viral myositis".
2. 5.1.1.2 (provider – information provider) – An example information need was the "History of doctors moving into management".
3. 5.1.1.3 (provider - trainee) – For example "Assessing DVDs and CD ROMs as learning tools".

The top three categories for GPs were:

1. 5.1.1.1 (provider – continuing medical education) - An example question was "What is polyostotic fibrous dysplasia?"
2. 5.2.1.1 (administration) - An example information request in this category was "Information on the use of the advanced access appointments system in general practice".

   5.1.1.3 (provider - trainee) – For example "Multi-disciplinary education in general practice: effects on patient care".

The difference between the two was the category of 5.1.1.2 (education – provider – information provider) from acute-sector doctors and the administrative (5.2.1.1) category from the GPs.

One category with no GP questions compared to acute-based doctors' questions was 5.4.1.1 (legal). The one acute question in this category was "What legislation relates to safety and security of parents and their babies?"

Three categories had no acute-sector doctor questions:

- 5.1.2.1 (education – patient). An example of a GP question was "What patient education leaflets are available on sexually transmitted diseases?"
- 5.8.1.1 (religion / culture). The GP question posed on religious grounds was "Are there any guidelines or an overview on what forms of contraception are acceptable / unacceptable to the various ethnic populations in the UK? As an example, a strictly observant catholic would only use natural family planning." The GP information request concerning culture was "Cultural considerations in prescribing medication."
- 5.10.1.1 (IT / Internet). An example of a GP request for assistance was "Information and guidance on Internet access policies."

The top ten categories for GPs and acute-sector doctors are illustrated and compared in Table 4.9.

Table 4.9: Comparison of The Top Ten Responses from Acute-sector Doctors and GPs

	Acute	GP
1	How should I treat finding/condition y given situation z? - 19.5% (213)	How should I treat finding/condition y given situation z? - 13% (70)
2	Is drug x indicated in situation y or for condition y? - 16.2% (177)	Is drug x indicated in situation y or for condition y? - 11.5% (62)
3	How should I manage condition/finding/situation y? - 7.9% (86)	How should I manage condition/finding/situation y? - 8.9% (48)
4	Is test x indicated in situation y? - 5.5% (60)	Could finding y be caused by drug x? - 4.4% (24)

5	I need to learn more about topic x. - 5.1% (56)	Is drug x safe to use in situation y? 4.3% (23)
6	What are the manifestations (findings) of condition y? - 4.2% (46)	When (timing, not indication) or how should I start/stop drug x? - 4.1% (22)
7	What is the usual course (or natural history) of condition y? - 3.8% (42)	I need to learn more about topic x. - 3.3% (18)
8	Is x a risk factor for condition y? - 3.7% (40)	Should this kind of patient get prophylactic drug x to prevent condition y? - 3.1% (17)
9	What is the cause of symptom x? - 3.6% (39)	Why did provider x treat the patient this way? - 2.6% (14)
10	How good is test x in situation y? - 3.1% (34)	How good is test x in situation y? - 2.6% (14)

One category in the top ten for acute-sector doctors (not listed in the overall top ten) was 1.3.2.1 (diagnosis – test - accuracy).

Five of the GP categories are not listed in the overall top ten: 2.1.1.3 (treatment - drug prescribing – how to prescribe); 2.1.2.2 (treatment – drug prescribing – drug of choice - prevention); 2.1.3.3 (treatment – drug prescribing – adverse effects); 3.2.1.1 (management – practices of other providers); and 1.3.2.1 (diagnosis – test – accuracy).

Both the top two questions asked by GPs and acute-based doctors relate to treatment (either drug or intervention) and combined account for nearly one quarter of all GP questions (24.5%) and over a third (35.6%) of those from acute-sector doctors. The acute-based doctors ranked diagnosis categories in fourth, sixth and eight places compared to the treatment categories of GPs. In ninth place GPs ranked 3.2.1.1 (management – practices of other providers) compared to 1.1.1.1 (diagnosis – cause – symptom).

4.3 Online Questionnaire Data

SurveyMonkey.com recorded the start and finish time for each respondents. From data, the average length of time taken to complete the questionnaire was 6.92 (six minutes 54 seconds), with a standard deviation of 3.95, but more significantly a skew of 4.565 which illustrates how frequently the responses were completed at the lower end of the time frame. The average completion time was under the 10 minutes that was suggested in the invitation to participate in the research. This demonstrated the usefulness and validity of the pilot questionnaire, which assisted in the determination of the suggested time required to complete the questionnaire.

SurveyMonkey.com also recorded the IP address of the questionnaire respondent. This is literally the address for the computer, both physically (by identifying the server location) and by organisation. Over 54% of the responses came from IP addresses between 194.176.105.39 and 194.176.105.44. Utilising an IP address finder website (http://www.ip-adress.com/), these sites were all found to be registered to the NHS. There were other smaller groupings, such as eighteen responses from 195.10.45.139, which was also registered to the NHS. Therefore at least half of the responses came from NHS-domains. It is not possible to be state exactly how many responses were from NHS computers. However, just because the response was not from an NHS computer does not mean that the respondent did not work in the NHS. Thirty-five percent of responses were from distinct, individual IP addresses. These may be home computers of NHS doctors.

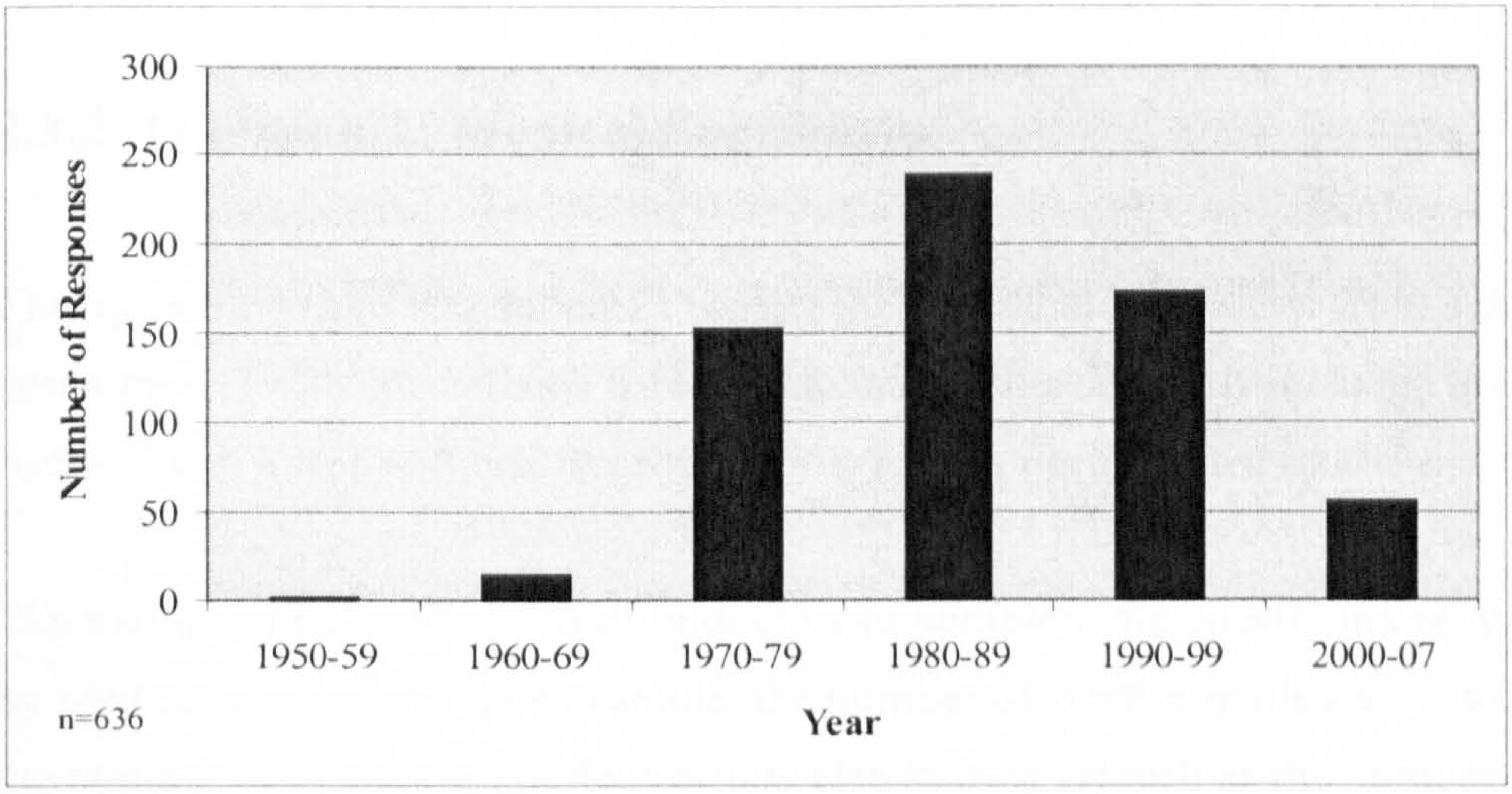
Some respondents did not complete the questionnaire. Therefore the numbers and associated percentages stated are based on the total number of responses for each individual question.

4.3.1 Question 1: Year of Medical School Graduation

This first question asked which year the respondent graduated from medical school. This option was chosen rather than asking for the respondents' age, as not every doctor attends and then graduates immediately after completing their compulsory education in a continuous progression. The drive in broadening access to undergraduate medical education has encouraged mature students to retrain as doctors (Howe et al., 2004; Angel & Johnson, 2000). Therefore personal age does not necessarily indicate medical experience. Thus, this question requests the year of medical school graduation, since that is more relevant.

Figure 4.1 illustrates the decade respondents graduated from medical school. The three decades between 1970 and 1999 account for 89% of the responses, whilst 36% of respondents qualified since the introduction of EBM and personal computers (1990 to 2007).

Figure 4.1: Decades Respondents Graduated from Medical School



On average the respondents had graduated from medical school twenty-one years ago. This relatively high figure suggests that the majority of respondents were not junior doctors, but were more experienced so in the hospital setting are likely to be consultants. The average for the acute-based doctors was twenty years and for the GPs, twenty-three.

The specific reason for asking this question was to enable further analysis of the data based on the years since graduating medical school. This is particularly important in this context since EBM and personal computer usage is only a recent phenomenon, growing rapidly over the last ten to fifteen years. The last ten years (1998 to 2007) have seen the acceptance and use of EBM and electronic health information resources. The previous ten years (1988 to 1997) were the "pioneer" years with early end-users adopting EBM (originated in 1992) and computerisation. Prior to this period use of computers for health information by doctors was rare due to the costs involved in using these technologies. Therefore these three breakdowns have been utilised to compare differences in time since graduating medical school. Only those analyses that illustrate significant differences have been included in these results.

4.3.2 Question 2: Medical Specialism

This question asked respondents to select their medical specialism from a drop-down menu (with specialisms listed in alphabetical order), that included the option "other" with a free text box to provide information not included on the list.

The majority of e-mails requesting doctors to complete the questionnaire were sent by medical specialism. For example, the number of A&E e-mails sent is known, the number of messages not delivered is also known, as well as the number of responses from A&E doctors. A tentative response rate can thus be calculated for each specialism. For example, sixty-four A&E e-mails were sent out, of which forty-seven were delivered (73%). Sixteen respondents defined their medical specialism on the questionnaire as A&E, which is 34% of those who received an e-mail (that is the e-mail message was successfully delivered). However, there are areas of ambiguity. For example, a paediatric A&E consultant could select either specialism (A&E or Paediatrics). Therefore, the only specialism with a high degree of reliability was the General Practitioners (GPs).

Table 4.10: The Percentage of E-Mails Delivered and Questionnaire Responses by Specialism

Medical Discipline	Emails Sent	Emails Delivered	% Delivered	Responses	% Response
A&E	64	47	73%	16	34%
Anaesthetics	112	97	87%	35	36%
Cardiothoracic	187	181	97%	33	18%
Cosmetic and Plastic Surgery	120	116	97%	12	10%
Critical Care	33	29	88%	5	17%
Dermatology	38	31	82%	2	6%
Ear, Nose and Throat	25	21	84%	8	38%
Endocrinology	32	26	81%	4	15%
Gastroenterology	35	27	77%	8	30%
General Practice	1389	913	66%	256	28%
Geriatrics or Elderly Medicine	***32***	***24***	***75%***	***5***	***21%***
Haematology	***25***	***16***	***64%***	***12***	***75%***
Immunology and Allergy	***28***	***23***	***82%***	***5***	***22%***
Infectious and Communicable Diseases	17	15	88%	11	73%
Neurology	55	44	80%	9	20%
Obstetrics, Gynaecology and Fertility	51	40	78%	11	28%

Oncology	31	24	77%	10	42%
Ophthalmology	***25***	***18***	***72%***	***9***	***50%***
Orthodontics	62	51	82%	9	18%
Orthopaedics	100	72	72%	15	21%
Paediatrics	46	35	76%	23	66%
Pain Management	18	15	83%	6	40%
Palliative Care	17	7	41%	5	71%
Pathology	***10***	***4***	***40%***	***12***	***n/a***
Psychiatry	96	71	74%	24	34%
Public Health	28	25	89%	16	64%
Respiratory Medicine	32	32	100%	13	41%
Rheumatology	26	19	73%	8	42%
Sexual Health	44	44	100%	6	14%
Surgery	79	61	77%	21	34%
Urology	27	23	85%	3	13%

Table 4.10 illustrates the number (and percentage) of e-mails that were actually sent, delivered to doctors' e-mail accounts and the number (and percentage) of questionnaire responses from each specialism. The five emboldened and italicised specialisms are those that were also promoted via the relevant organisation or Royal College. This explains the mathematically impossible result of twelve responses from "pathology", when only four e-mails were actually delivered to doctors e-mail accounts.

Two e-mails were received from administrative staff who managed their doctors' e-mail accounts as the medical professional was not IT literate. Ms MB sent "Many apologies, Dr GB does not use the computer at all."

The main reason for requesting a response to this category was to be able to compare responses from doctors based in the acute-sector to those working in general practice. In these comparisons, Public Health doctors have been removed as their role is generally to manage population events, rather than individual patient care. Those responders who selected other and then entered their own option were also reviewed. Eleven of these were eliminated from the comparisons as their place of work (acute, general practice or other) could not be ascertained. These included responses such as occupational health and rehabilitation. House officers undertaking their general training were also excluded due to their educational and learning status. Therefore, for the further analysis, 353 responses were from acute-sector based doctors and 256 from general practitioners. Only those analyses that illustrate significant differences have been included in these results.

4.3.3 Question 3: Country of Residence

This question was included to eliminate respondents who no longer worked in the UK, but received an e-mail regarding the questionnaire or found the URL from one of the websites or received information about the research from one of the electronic newsletters. Six responses were received from outside the UK (Australia, India, Ireland (2), Russia and Switzerland) which were not included in the subsequent analysis.

In total, 675 UK responses were received. Thirty-nine responses (5.8%) only completed the first page which included the questions on year of medical school graduation, medical specialism and country of residence. There are numerous potential reasons for not continuing to complete the questionnaire, such as:

- The next question regarding information needs answered by accessing electronic information put off respondents due to its length or lack of relevance to them;
- Time, either a lack of time or a purpose decision not to spend any more time on the questionnaire;
- Work pressures. This is linked to time, but the difference in this case is that the intention was there to complete the questionnaire, but other commitments prevented completion;

- Respondents were interrupted and never returned to complete the questionnaire;
- The medium itself. Several respondents e-mailed to state that they were unable to move through the survey, for example, "I tried to do this but it kept seizing up...sorry" [Dr D];
- Whilst the anticipated time to complete the questionnaire was included in the e-mail, the number of questions was not, so potentially these respondents did not realise that further questions (on subsequent pages) existed.

Overall, 636 questionnaires were successfully completed.

4.3.4 Question 4: Information Needs Accessed Electronically

This question asked respondents to specify whether they answered information needs electronically, all the time, sometimes or never, with regards to:

- Information to assist with diagnosis;
- Treatment options for common diseases;
- Information on rare diseases and syndromes;
- Drug information (including new drugs and contraindications);
- Information to give to patients;
- Information for study for further qualifications;
- Continuing professional development;
- Research;
- Teaching.

Figure 4.2 illustrates the responses for patient care information needs. The responses for "never" and "all the time" provide interesting results. Nearly a quarter (24.2%) of doctors responded that they didn't use electronic resources for treatments for common diseases and a fifth (20.1%) did not use electronic resources for drug information. However, information on rare diseases and syndromes was accessed using electronic resources by 26.1% "all the time" and for information to give to patients by 18.1%.

Figure 4.2: Responses for Patient Care Information Needs Accessed Electronically

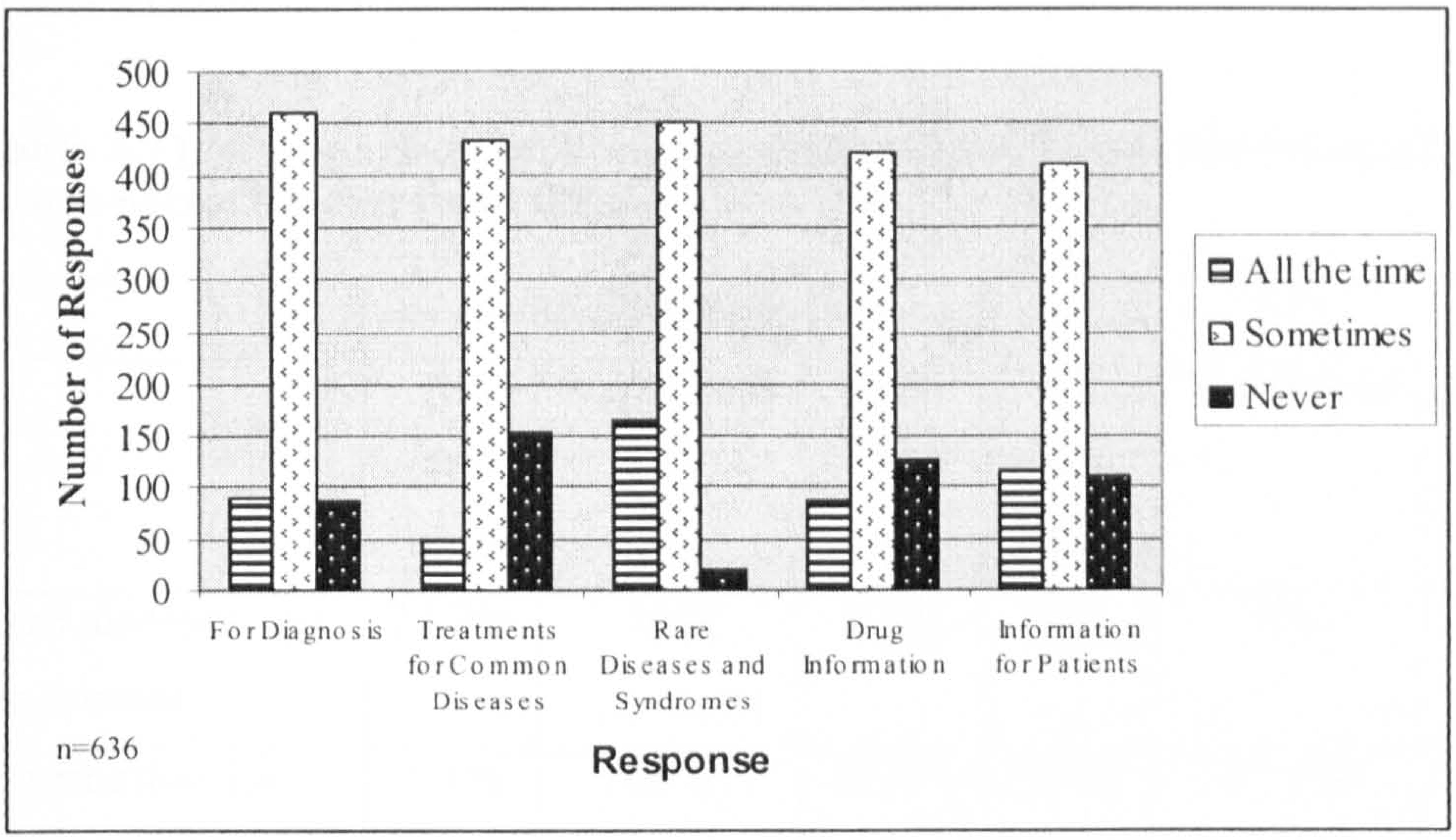
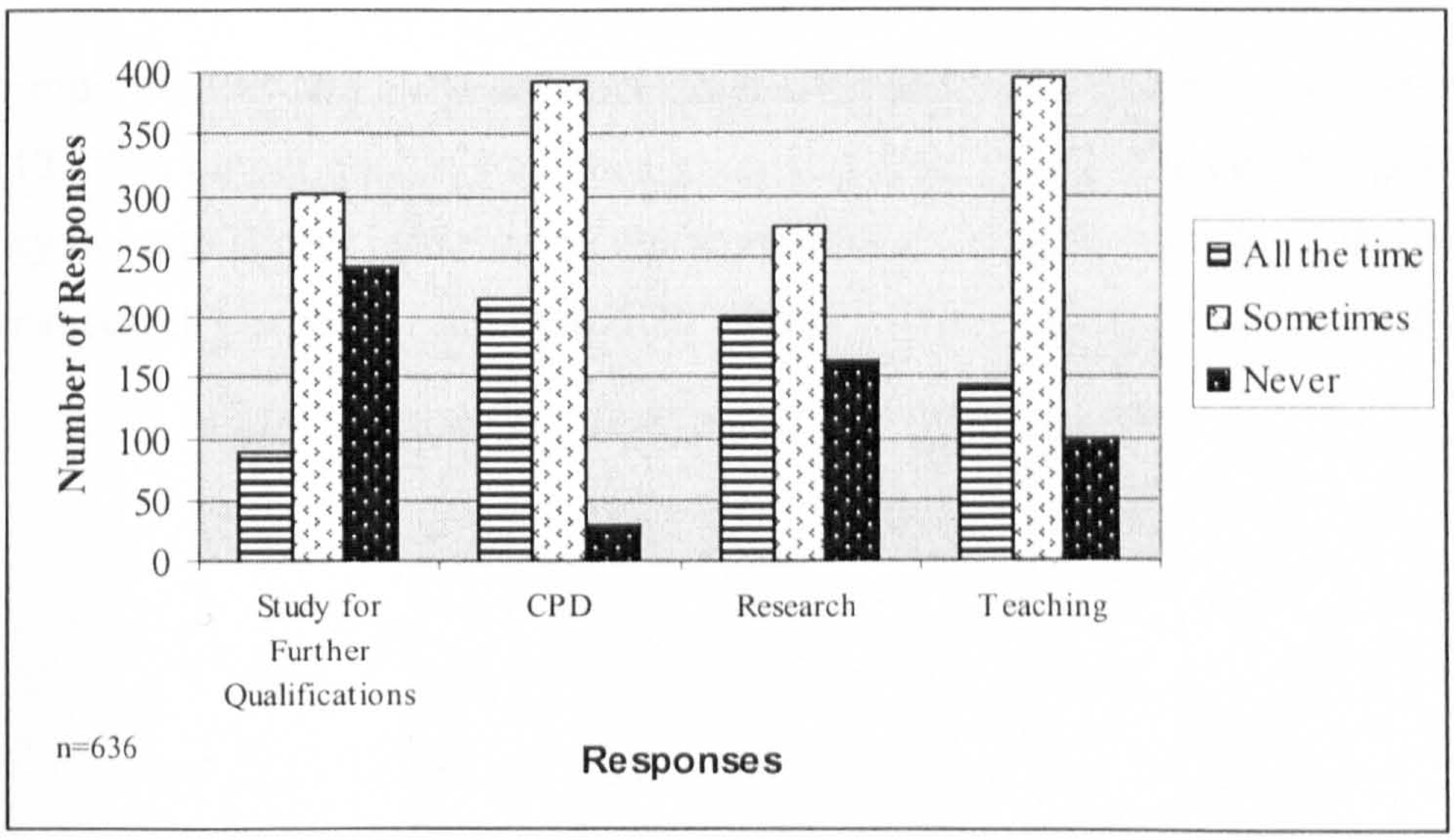


Figure 4.3 illustrates the responses for non-patient related information needs accessed electronically. The two least popular reasons for accessing electronic resources was to gather information for further qualifications (38.2% responded with "never") and research (25.5% "never"). Continuing professional development was the most important aspect with less than 5% (4.6) stating they "never" used electronic information for this purpose.

Figure 4.3: Responses for Non-Patient Related Information Needs Accessed Electronically



The responses to accessing information needs electronically were compared from acute-sector based doctors and those working in general practice. Four categories produced different results, as illustrated in Table 4.11.

Table 4.11: Comparison of Accessing Information Needs Electronically from Acute-Sector Doctors and GPs

	Acute-Sector Doctors			GPs		
	All the time	Sometimes	Never	All the time	Sometimes	Never
Rare diseases and syndromes	27.2%	70%	2.8%	25%	2%	73%
Information for patients	7.4%	68%	24.6%	33.2%	61.7%	5.1%
Research	49.3%	45.3%	5.4%	5.9%	39%	55.1%
Teaching	32%	64.6%	3.4%	9.4%	59.8%	30.8%

GPs were less likely to access electronic information for rare diseases and syndromes, as 73% responded "never" to this category compared to 2.8% of acute-sector based doctors. GPs were also less likely to access electronic information for research (55.1% "never" compared to 5.4%) or for teaching purposes (30.8% compared to 3.4%). GPs were more likely to access electronic resources to provide information to give to patients, 33.2% of GPs responded "all the time" compared to 7.4% from acute doctors.

Comparing the data by years since graduation produced the results shown in Table 4.12. The longer doctors had been graduated from medical school the less likely they were to access information electronically to study for further qualifications or for research purposes (48.1% and 29.3% for "never" response, respectively).

Table 4.12: Comparison of Access of Electronic Information By Years Graduated from Medical School

	Never		
	1-10 years	11-20 years	21+ years
Study for further qualifications	7.4%	35.6%	48.1%
Research	11.7%	25.3%	29.3%

4.3.5 Question 5/6: Formulate Questions and Search the Literature

The next two questions focussed on locating the evidence. The first asked the frequency that specific questions were formulated and the second how often the literature was searching for the evidence. Both question provided the same response options:

- Less than once a month;
- Less than once a week;
- Between one and five times a week;
- Between six and ten times a week;
- More than ten times a week.

Over 60% of respondents searched the literature a maximum of once a week (or less than four times a month) and 29.3% less than once a month. Only a third of respondents searched the literature between one and ten times a week. Firschein, Summit & Mick (1981) suggest that to maintain search skills, five to ten searches per month are required. Therefore only a third of the respondents in this research were conducting enough searches to maintain a reasonable skill level. This obviously raises serious issues as the second step in the practice of EBM is locating or searching for the relevant evidence.

Figure 4.4: Comparing Formulation of Questions and Searching the Literature

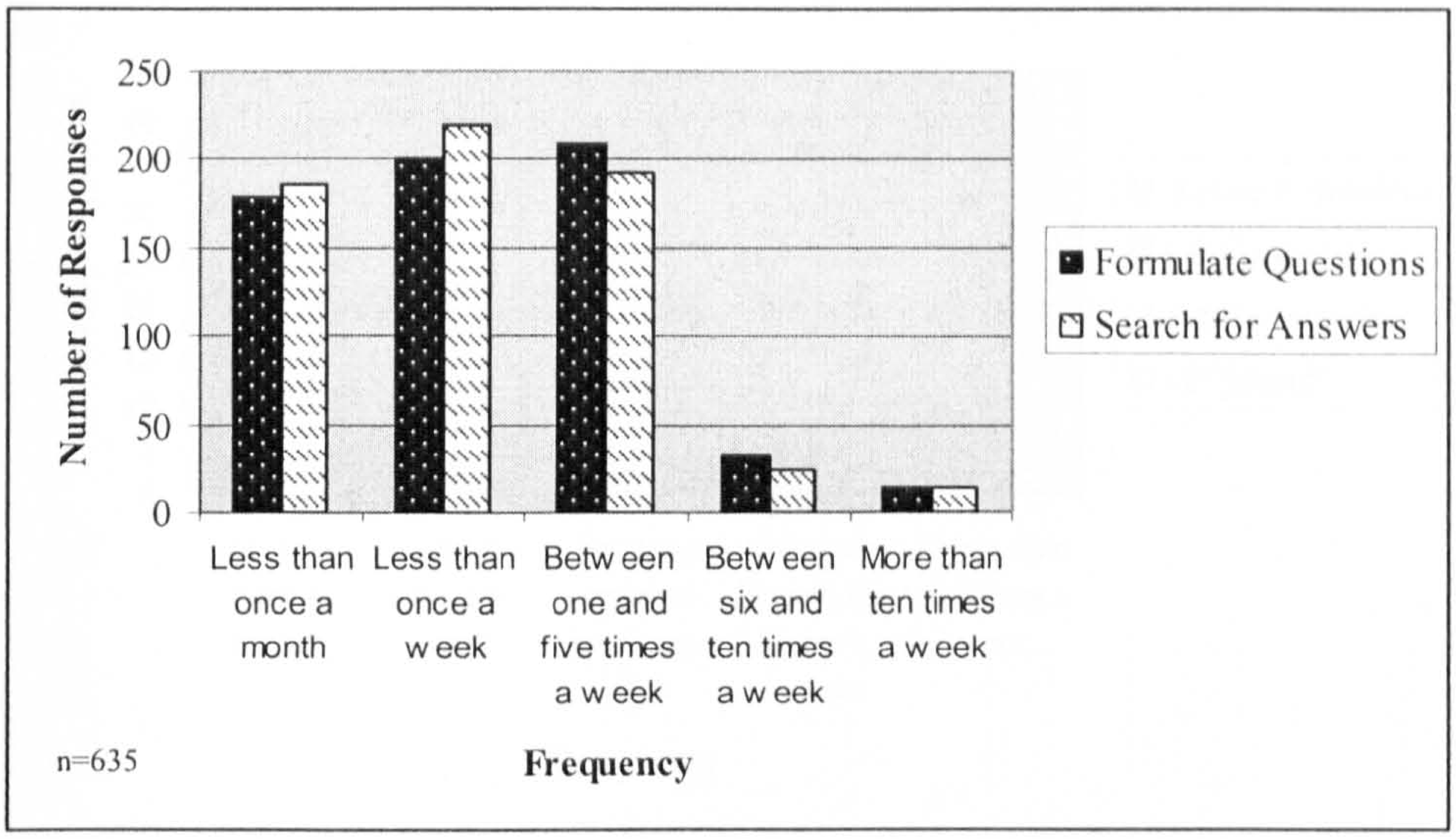
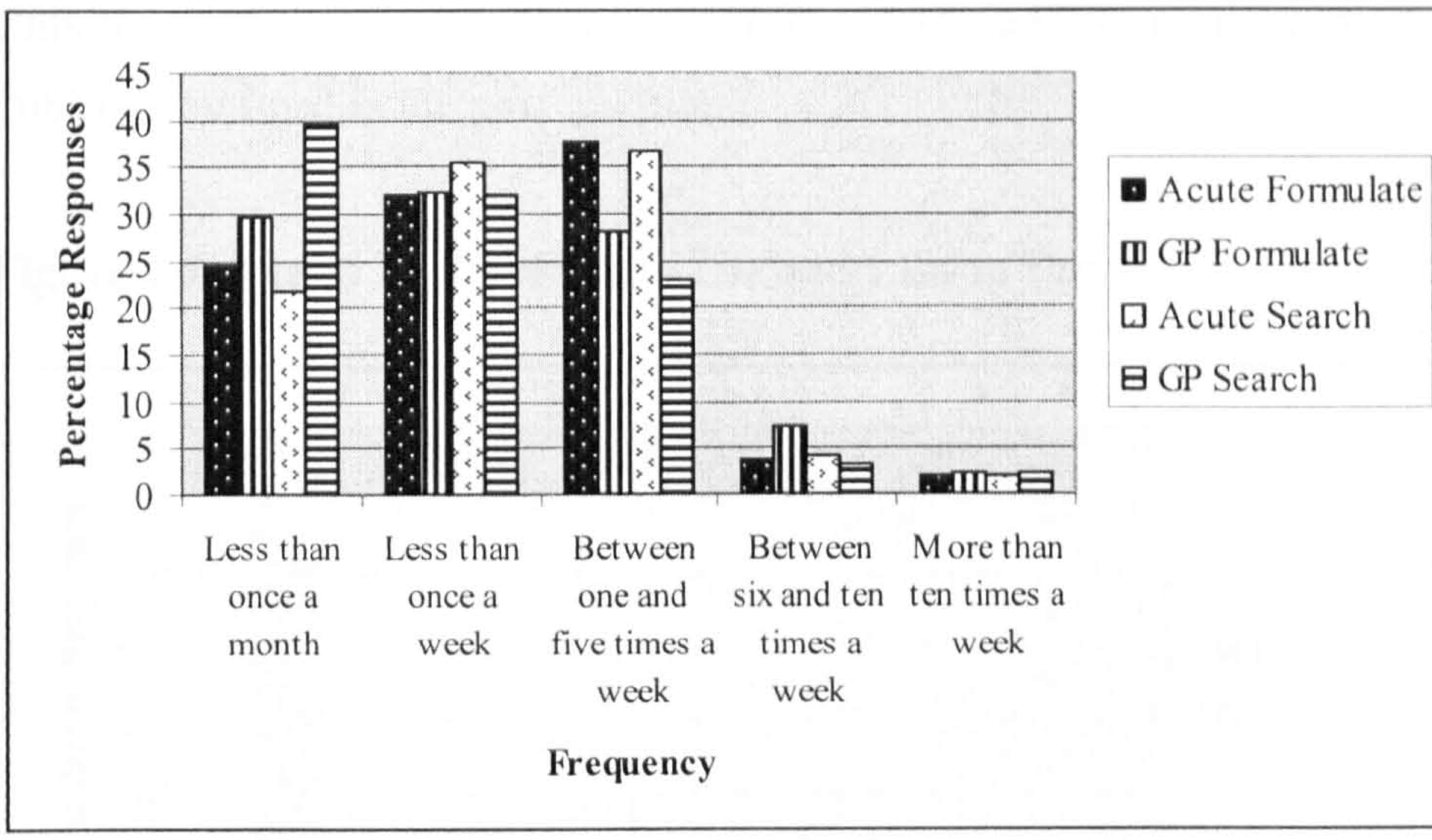


Figure 4.4 illustrates that where less questions were generated (less than once a month or once a week) then searching the literature exceeded the frequency of question formulation. This suggests that doctors with few information needs are actually less able to adequately formulate search strategies. Thus requiring more searches to answer a specific information need. More questions were formulated than literature searched when questions were generated more than once a week. This may reflect the impact of time. Questions were formulated, but the doctors lacked the time to search the literature for the evidence to answer all the questions generated.

When comparing the same data by sector worked in, namely hospital or general practice, differences were highlighted as illustrated in Figure 4.5. GPs formulate questions and search the literature less frequently than doctors in the acute-sector. When comparing searching the literature a maximum of once a week (includes "less than once a week" and "less than once a month"), 71.4% of GPs responded to this compared to 57.2% acute-sector doctors. GPs deal with a more varied patient care workload, but much is routine patient-care management. The acute-sector doctors are more specialised, but also deal with the more unusual rare situations that require a literature search.

Figure 4.5: Comparison of Question Formulation and Literature Searching By Acute Doctors and GPs



In a survey of general practitioners, 45% expected to do so a minimum of once a fortnight (Tovey & Godlee, 2004). In this research, 60.4% of GPs searched at least once a fortnight. The Tovey & Godlee (2004) research focussed on one resource, Clinical Evidence, whilst this research considered a range of EBM resources. This could explain the higher response rate in this research.

Comparing the data by years since graduation did not produce different results.

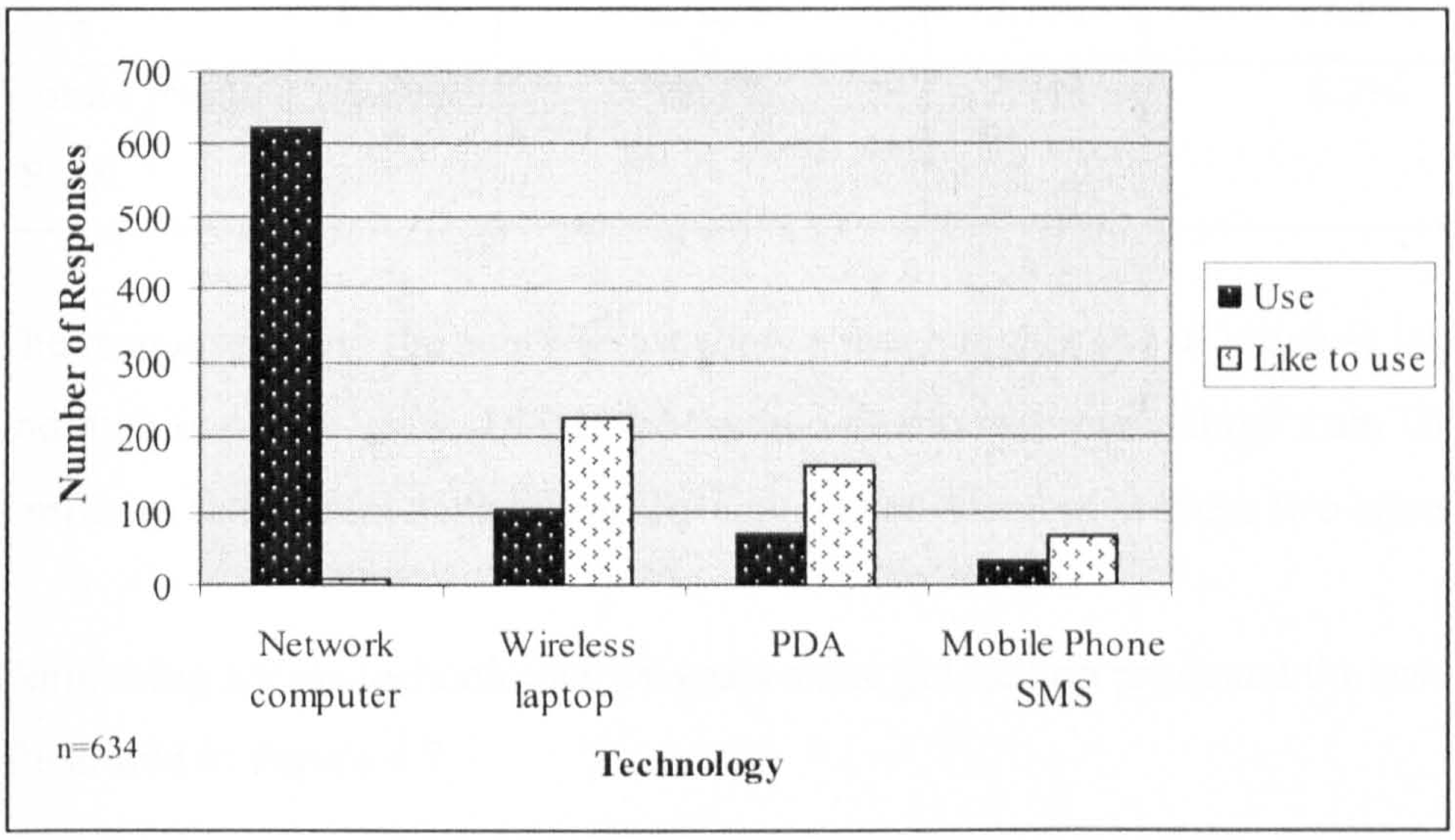
4.3.6 Question 7: Currently Access and Would Like To Access Electronic Information

Respondents were asked how they currently accessed electronic information at work and they would you like to access this information. The options given were:

- Networked Computer;
- Wireless Laptop;
- PDA;
- Mobile Phone - SMS Messenger.

Figure 4.6 illustrates the responses to this question. Ten respondents (1.6%) responded that they did not currently use a networked computer, but would like to. Only one of these ten did not use any of the search facilities used on Medline / PubMed, outlined in the next question.

Figure 4.6: Access Technologies – Use and Like to Use



The wireless laptop, PDA and mobile phone SMS were all methods of accessing information that double the number of respondents would like to use than currently used.

The responses to these access technologies were compared from acute-sector based doctors and those working in general practice. The network computer responses were similar, but as illustrated in Table 4.13, the other technologies produced different responses.

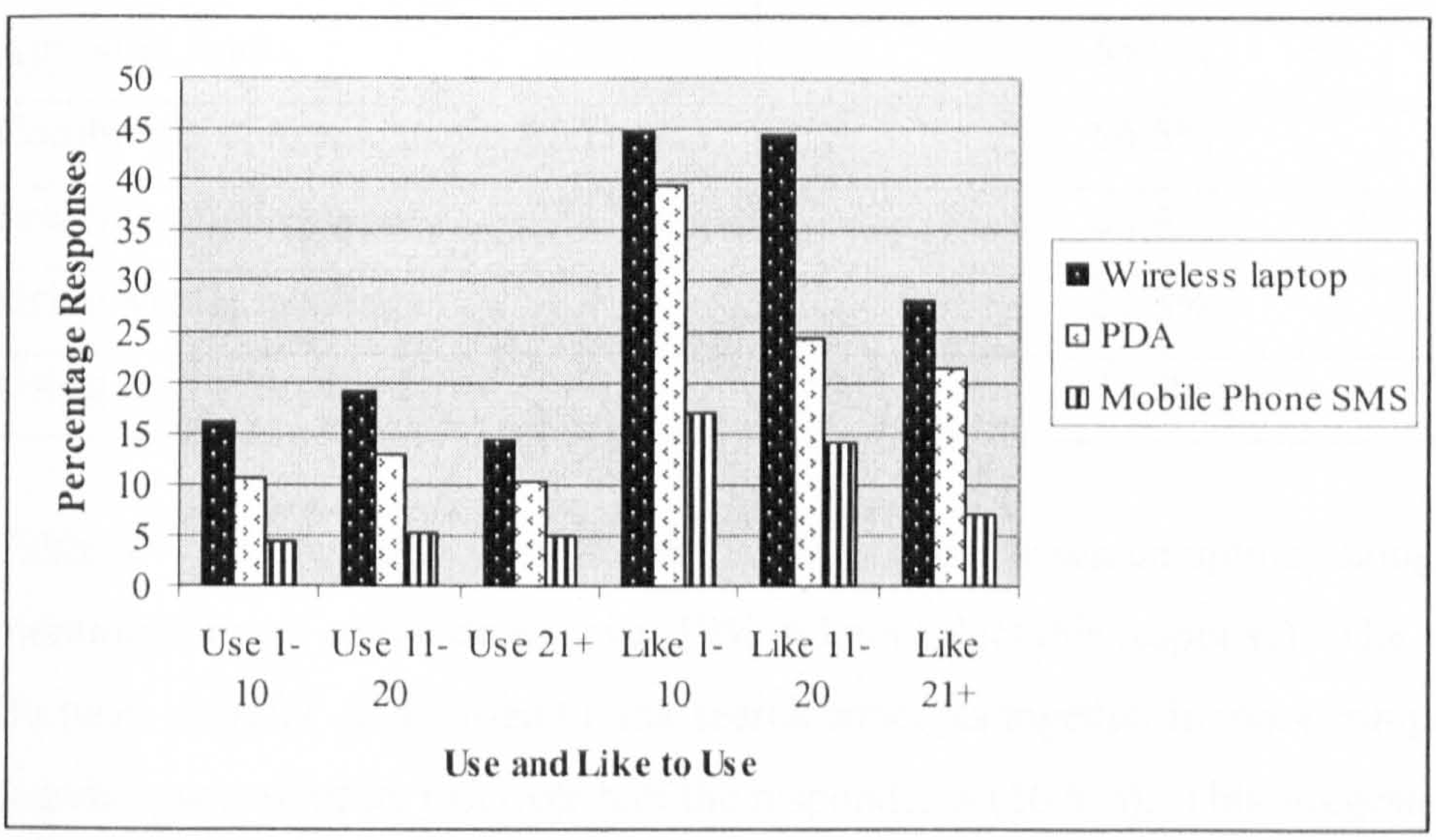
Table 4.13: Access Technologies – Use and Like to Use by Acute Doctors and GPs

	Acute		GP	
	Use	Would Like to Use	Use	Would Like to Use
Wireless laptop	19.8%	45.9%	9.3%	20.2%
PDA	12.2%	27.2%	9.7%	21.8%
Mobile phone - SMS	6.8%	12.7%	2.7%	8.2%

The responses from the acute sector show a much higher use of wireless laptops and mobile phone SMS. In fact the "would like to use" percentage from GPs is similar to the current actual "use" by acute-sector doctors in these two areas.

Comparing access technologies by years since graduation produced the results illustrated in Figure 4.7.

Figure 4.7: Access Technologies Compared by Graduation Years for Use and Like to Use



The "newer" technologies, wireless laptop, PDA and mobile phone SMS were all used the most by those that graduated between 11 and twenty years ago, closely followed by those that graduated in the last ten years. Those most recently graduated (less than ten years) are more likely to want to use these new technologies compared to those who have left medical school longer (over twenty years).

4.3.7 Question 8: Medline (or PubMed) Search Facilities Used

This question focussed on the skills that doctors are potentially able to utilise when searching Medline or PubMed. Respondents were asked if they searched Medline (or PubMed) and to identify the search facilities (respondents were able to select more than one option) they use:

- Applying limits (English language, human subjects only, date of publication);
- Combining two concepts using AND;
- Searching by keyword in a basic search entry box;
- Using MeSH (MEdical Subject Headings);
- Using the 'related articles' or 'similar titles' facility.

Table 4.14: Search Facilities Used by Doctors on Medline / PubMed

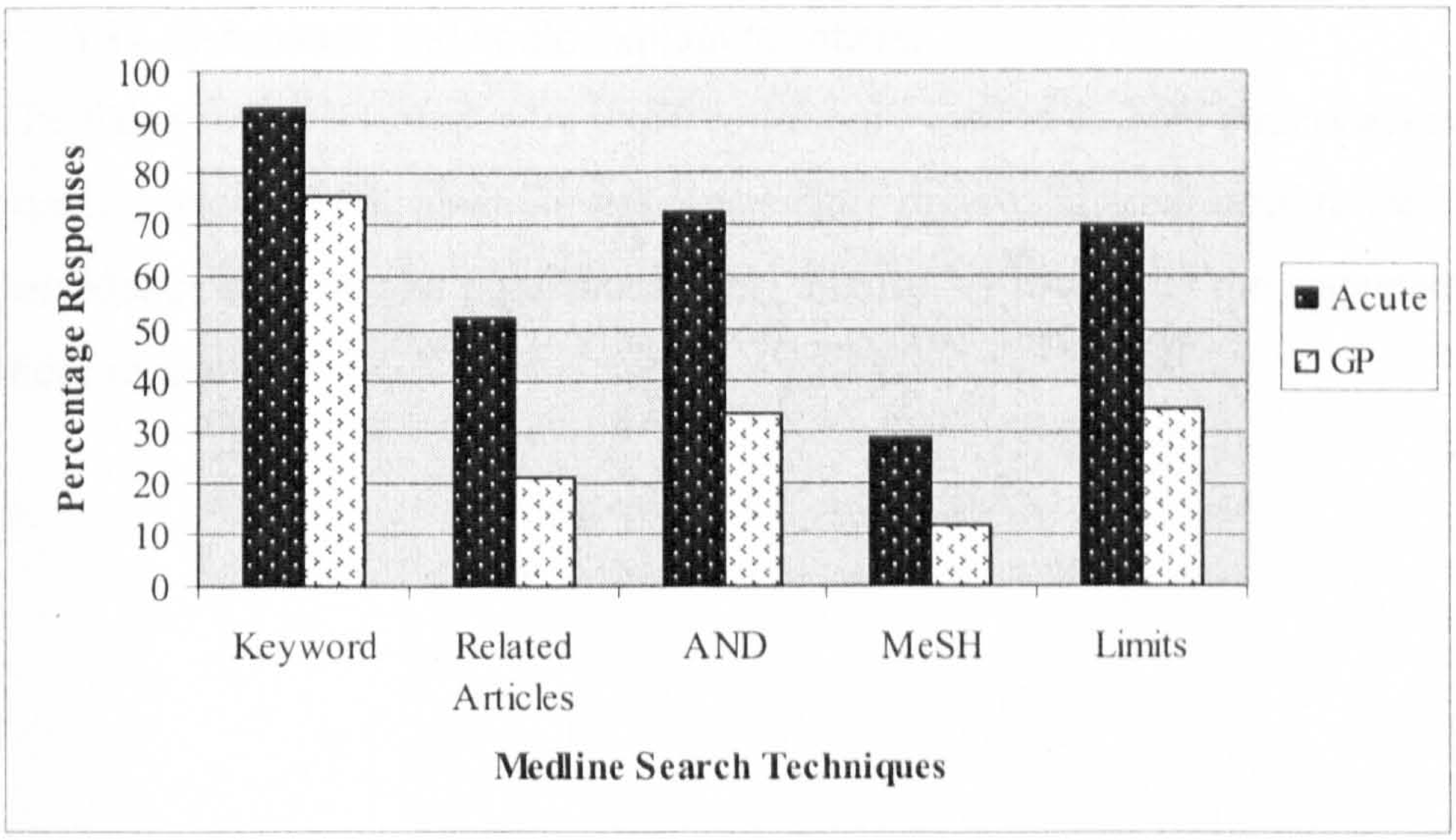
	Number of Responses
Applying limits	55.9%
Combining concepts using AND	56.5%
Searching by keyword	86.4%
Using MeSH headings	22.8%
Using the "related articles"	38.9%

Table 4.14 shows that keywords were the most popular search option, though not mentioned by all respondents (over 10% did not select this response). The Boolean operator AND, used to link search concepts together in more complex searches, was used by just over half the respondents (56.5%). This suggests that nearly half the respondents only undertake simple searches or do not employ effective search strategies for complex searches. Less than a quarter of respondents (22.8%) used the specialised MeSH (Medical Subject Headings) as a

search option. This highlights the fact that whilst doctors are willing to search for evidence, they lack advanced specialist search skills to enable them to maximise the effectiveness of their searches.

When comparing the responses between acute-sector based doctors and those in general practice, significant differences were noted, as illustrated in Figure 4.8. The search facilities "related article", "AND", "MeSH" and "limits" are used by twice as many acute-sector based doctors to GPs. The difference in "keyword" use is less significant, but the response from acute doctors was higher. This suggests that acute-sector doctors have been more readily able to improve their searching skills. Librarians provide most of the professional level training in literature searching, but most are based in the acute-sector. This may explain the difference in utilising search facilities between acute-sector doctors and GPs. This raises an important issue, namely, how to reach and train GPs to develop their searching skills. PRIMIS aims to help GPs improve patient care through the effective use of their clinical computer systems, but this does not include information-handling skills, such as literature searching and critical appraisal (http://www.primis.nhs.uk/pages/default.asp).

Figure 4.8: Percentage Responses to Searching Medline / PubMed from Acute Doctors and GPs



A comparison by years since graduation to this question produced differences in two search strategies, shown in Table 4.15. Those who had most recently graduated were more likely to "apply limits" and "combine using AND". This suggests that doctors who have recently left medical school are more sophisticated searchers.

Table 4.15: Differences in Search Strategies Used in Medline / PubMed Analysed by Years Since Graduation

	1 – 10 years	11 – 20 years	21+ years
Applying limits	66%	64.4%	48.6%
Combining using AND	67%	64.9%	49.1%

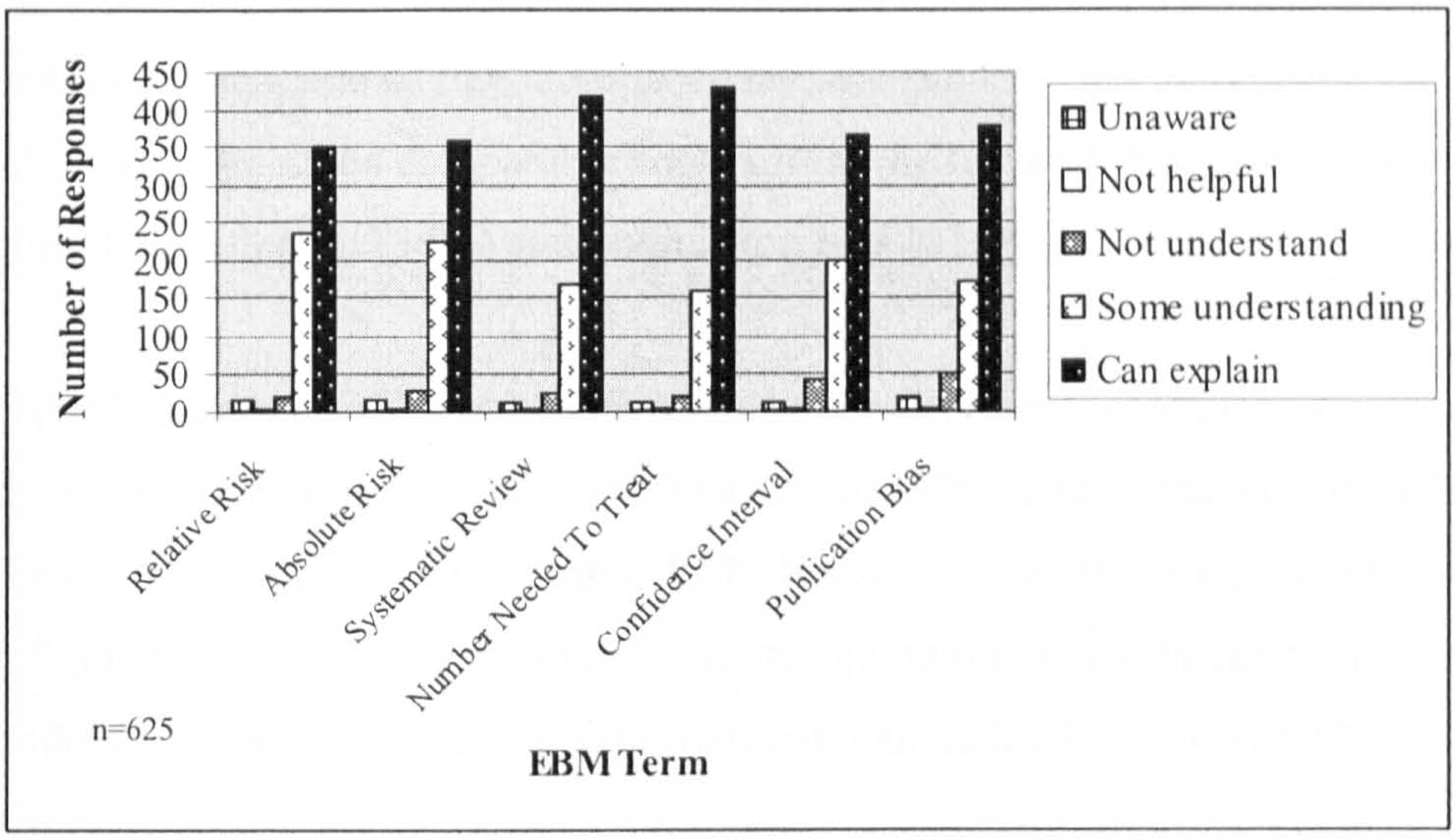
4.3.8 Question 9: Reaction to EBM Terms

Respondents were asked to indicate their reaction to EBM terms from the options of:

- I am unaware of this term;
- It would not be helpful for me to understand;
- Do not understand but would like to;
- Some understanding;
- Yes, understand and could explain to others.

The EBM terms selected were those commonly used in journal papers about EBM, namely, relative risk, absolute risk, systematic review, number need to treat, confidence interval and publication bias. Figure 4.9 illustrates the responses to these terms.

Figure 4.9: Responses to Understandings of EBM Terms



Over 85% of respondents were either able to explain the EBM term or had some understanding of them. The least understood term was publication bias, but still 87.8% perceived they had "some understanding" or "yes, understand and could explain to others".

The responses to these EBM terms were compared from acute-sector based doctors and those working in general practice. Two EBM terms produced different results, as illustrated in Table 4.16.

Table 4.16: Differences Between Responses to EBM Terms from Acute-Based Doctors and GPs

	Some understanding		Yes, understand and could explain to others	
	Acute	GP	Acute	GP
Confidence Interval	24.4%	43.2%	70.1%	40.8%
Publication Bias	20.7%	38.4%	72.1%	42.8%

Combining these positive responses shows that the acute-sector based doctors are more positive regarding their understanding of EBM terms. Acute-based doctors understood to some degree confidence interval (94.5%) and publication bias (92.8%). Whilst the comparable results from the General Practitioners were confidence interval (84%) and publication bias (81.2%).

Overall there was a slight decline in the understanding of EBM terms the longer the doctor had graduated from medical school. The differences were over 5% for three EBM terms, shown in Table 4.17. However, even those respondents who left medical school over twenty-one years ago, more than 90% felt they understood most of the EBM terms (except publication bias with 85.6%).

Table 4.17: Differences Between Responses to EBM Terms for Years Graduated Medical School

	Positive response – either "some understanding" or "yes, understand and could explain to others"		
	1 – 10 years	11- 20 years	21+ years
Relative Risk	97.8%	94.8%	92.4%
Absolute Risk	96.7%	93.8%	91.5%
Publication Bias	91.3%	90.1%	85.6%

4.3.9 Question 10/11: Awareness of EBM Resources

There are a number of database resources and specialised resources available electronically. Respondents were asked to which they were aware of or used. The options given to answer each resource were:

- I have never heard of this;
- Aware of but never used;
- Aware of, but would like more training before using;
- Use occasionally;
- Use regularly.

In the analysis, the resources have been divided into UK synthesised resources (freely available), US resources (non-synthesised / synthesised, free / fee-based), specialist UK resources and guidelines / CATs.

Figure 4.10: Comparison of Awareness and Use of UK Synthesised Resources

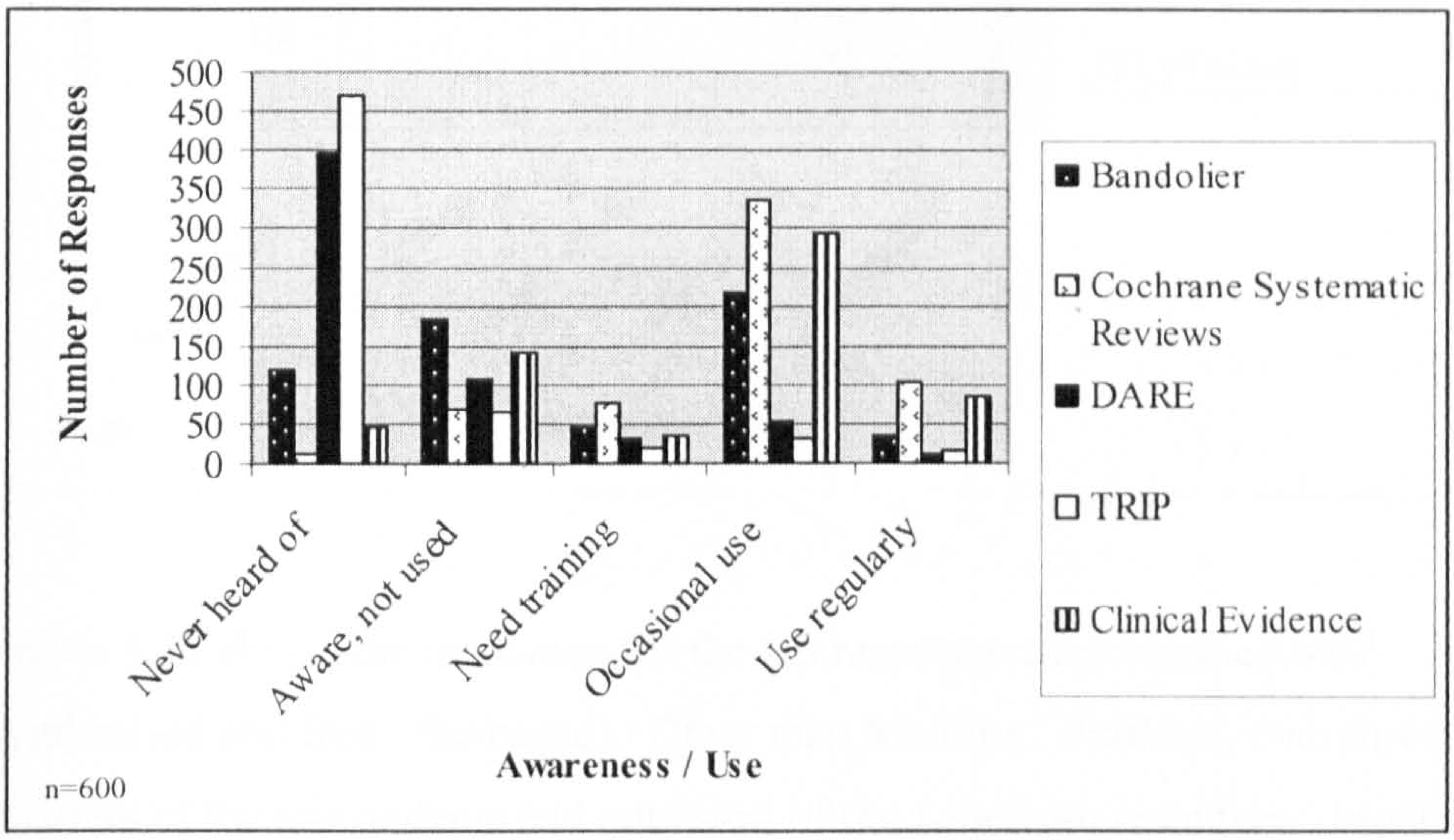


Figure 4.10 illustrates the comparison of the UK synthesised resources (freely available). This showed that TRIP was the resource most respondents had never heard of, followed by DARE (Database of Abstracts of Reviews of Effectiveness). The most frequently used, by nearly three-quarters of respondents (73.3% either "use occasionally" or "use regularly") was the Cochrane Database of Systematic Reviews, followed by Clinical Evidence (63%).

Figure 4.11: Comparison of Awareness and Use of US Resources

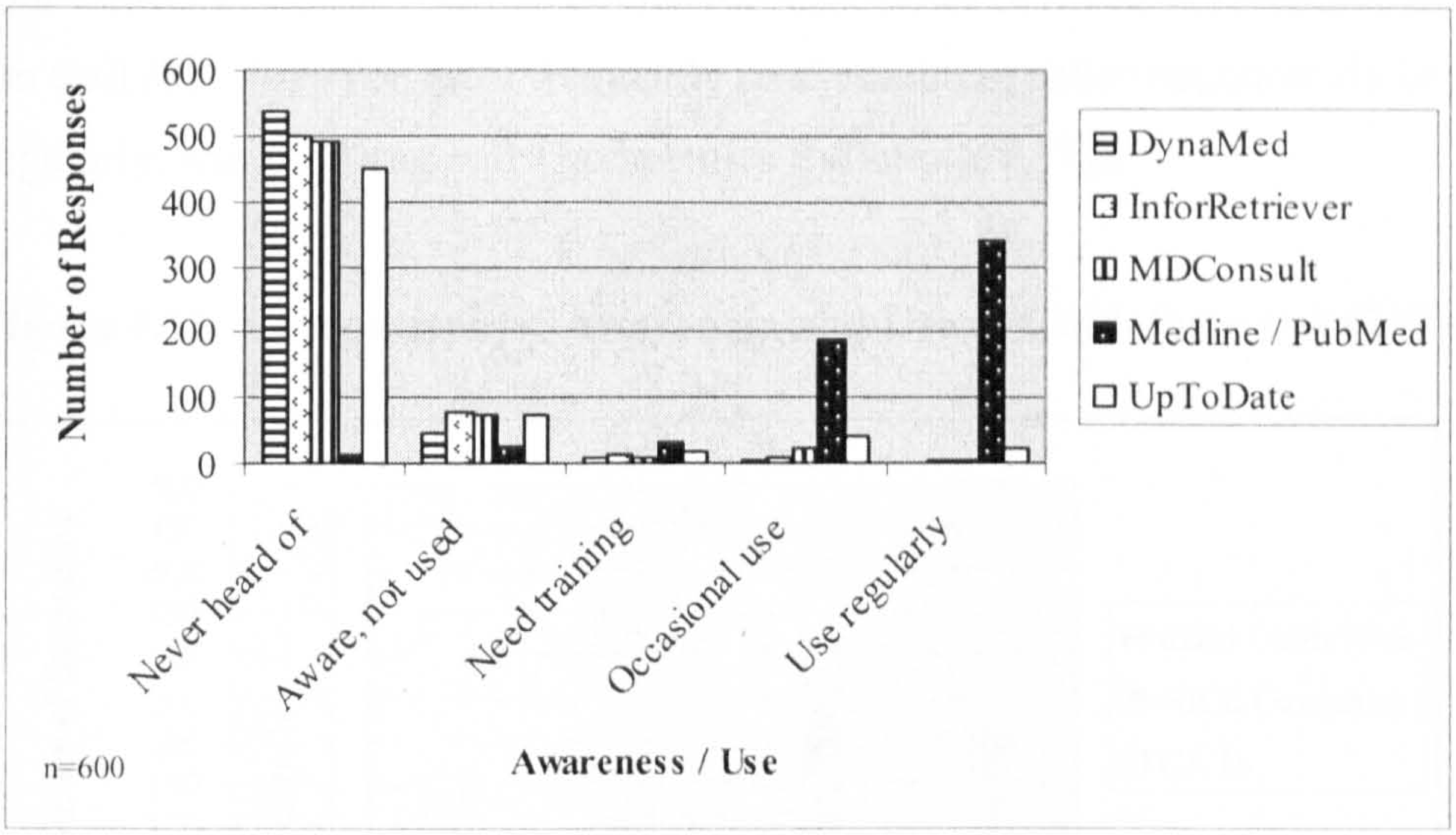


Figure 4.11 shows the responses for the US resources (non-synthesised / synthesised and free / fee-based). Other than Medline / PubMed, over three-quarters of the respondents had not heard of the American resources. Medline / PubMed was used (either occasionally or regularly) by 88% of respondents.

Figure 4.12: Comparison of Awareness and Use of UK Specialist Resources

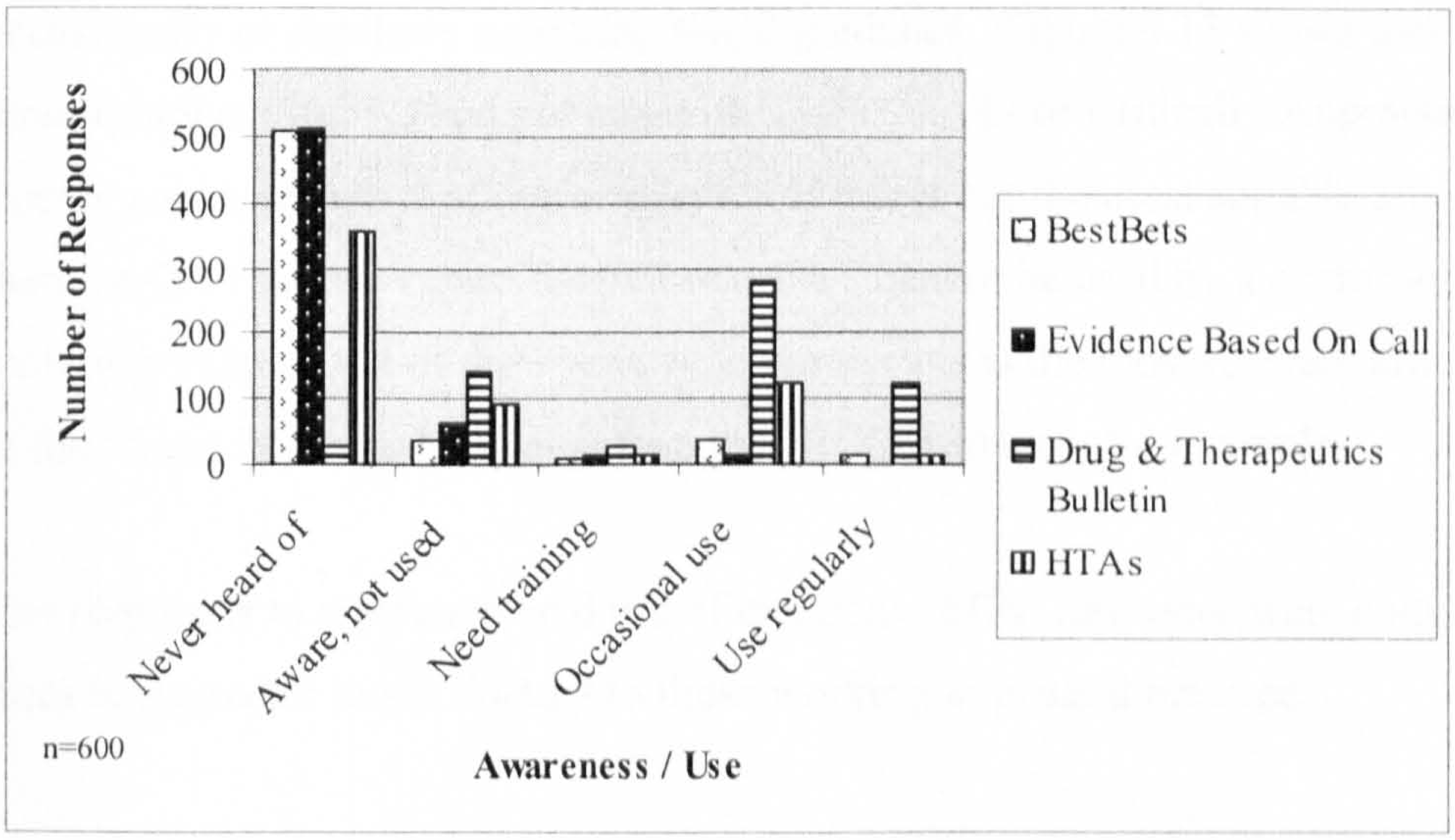
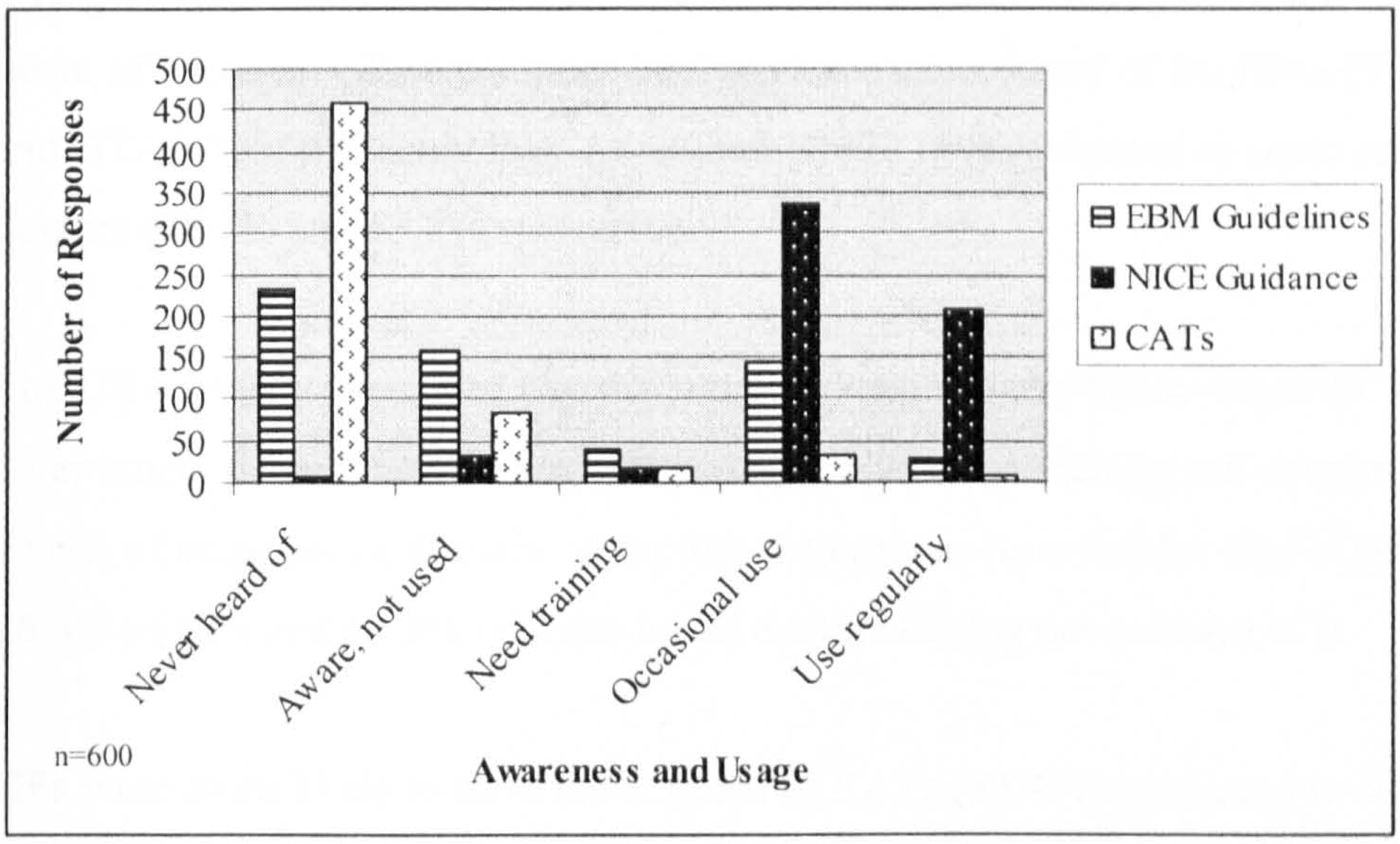


Figure 4.12 shows the awareness and use of UK specialist EBM resources. Over four-fifths of respondents had not heard of BestBets (84.5%) or Evidence Based On Call (85.2%). The most frequently used resource, either occasionally or regularly, was the Drug and Therapeutics Bulletin (67.3%).

Figure 4.13: Comparison of Awareness and Use of Guidelines and CATs



NICE guidance was the most used "guidance" resource, with 90.7% respondents occasionally or regularly accessing NICE guidance. Figure 4.13 shows that over three-quarters (76.5%) had not heard of CATs. CATs or Critically Appraised Topics are an appraisal of one article, but if this is not the most suitable article then the CAT has no value. Therefore a CAT cannot be used by a doctor without more work (appraisal of the literature to ensure this is the most relevant article) so in the "front-line" has less value than the NICE guidance, for example.

The responses to awareness and use of electronic EBM resources were compared from acute-sector based doctors to those working in general practice.

The UK synthesised resources (freely available) produced two different responses to the "never heard of" option. Five percent (5.4%) of GPs had never heard of Bandolier compared to 30.3% of acute-based doctors. The difference in lack of awareness of DARE was less marked with 63.4% of acute-based doctors having never heard of it compared to 73.9% of GPs.

The specialist UK resources also produced two different responses to the "never heard of" option. GPs were more likely to have never heard of BestBets (92.1%) and HTAs (Health Technology Assessments) (72.6%) compared to acute sector doctors (78.7% and 53.5% respectively).

The US resources produced two different responses to the "never heard of" option. Over ninety percent (90.9%) of GPs had never heard of MDConsult compared to 75.4% of acute sector doctors. A similar pattern was recorded for UpToDate, with 86.3% of GPs and 67.3% of acute-based doctors having never heard of it.

GPs were more likely to have never heard of CATs (83.4%) compared to acute-based doctors (71.8%). Therefore, awareness of CATs is low in both groups.

Comparing the results according to number of years since graduating medical school for not having heard of various UK resources produced the significant results shown in Table 4.18. The percentage of doctors who had not heard of Bandolier, TRIP, the HTAs (Health Technology Assessments) and CATs (Critically Appraised Topics) decreased the longer the respondent had graduated from medical school. This suggests that these resources have been successfully promoted in journals, at "Continuing Medical Education" events and conferences.

Table 4.18: Comparison of the Differences in Graduating from Medical School and Response of "Never Heard" of UK Resources

	I have never heard of this		
	1-10 years	11-20 years	21+ years
Bandolier	32.2%	22%	14.8%
TRIP	83.3%	81.2%	75%
HTAs	82.2%	78%	74.1%
CATs	82.2%	60.2%	53.4%

However the percentage of doctors who had not heard of UpToDate and EBM Guidelines increased the longer the respondent had graduated from medical school. Of those who graduated less than ten years ago, 68.9% had not heard of UpToDate and 32.2% EBM Guidelines, compared to those who graduated more than twenty-one years ago, 78.4% had not heard of UpToDate and 40.1% EBM Guidelines.

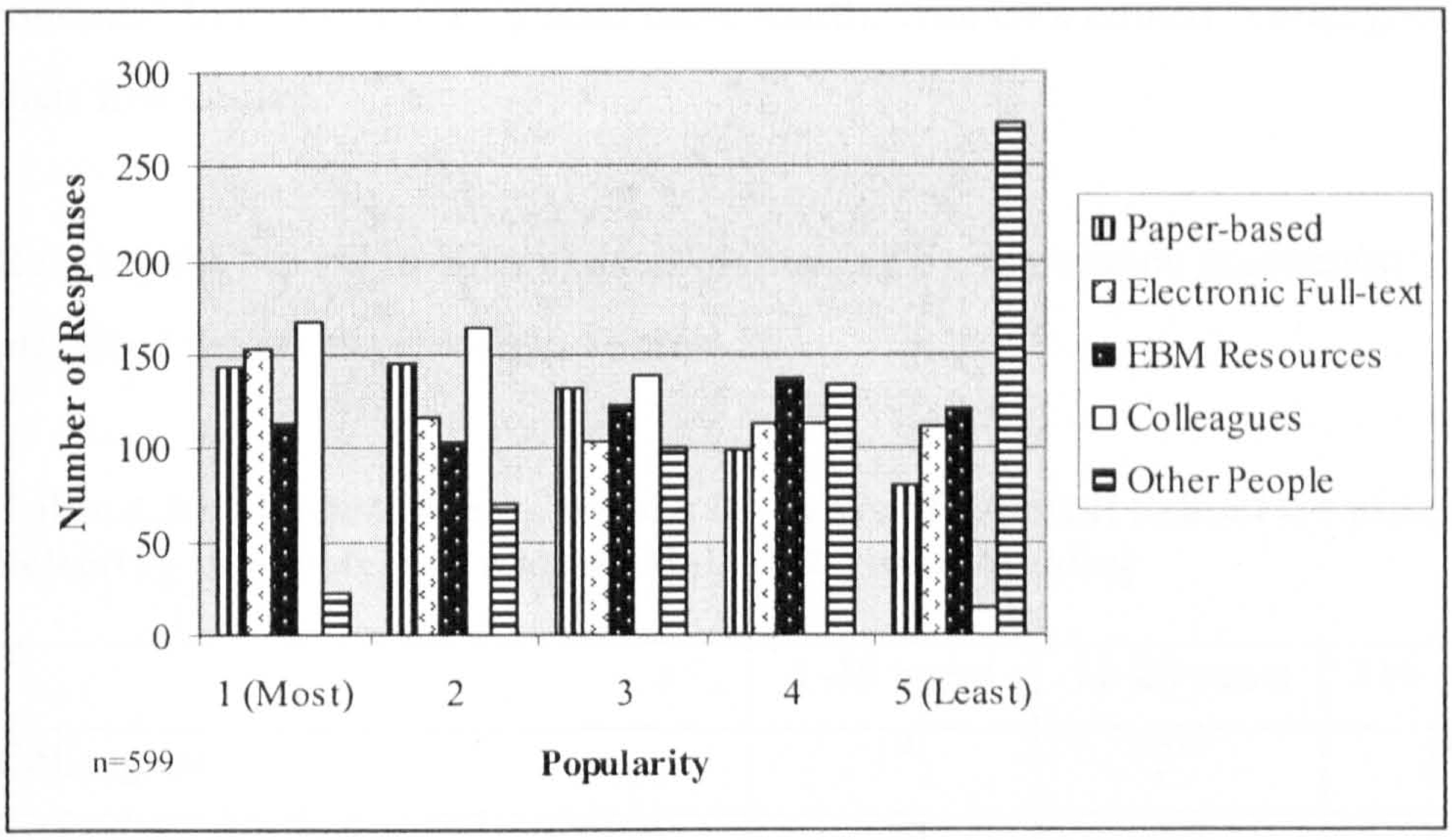
4.3.10 Question 12: Ranked Importance in Clinical Decision Making

This question requested respondents to rank the following in order of importance to them personally as an aid in clinical decision making:

- Textbooks or Journals (in paper format);
- Full text electronic journals;
- EBM resources listed above;
- Colleagues;
- Other health professionals, such as pharmacists.

Respondents were asked to select '1' for the most preferred / most used source, down to '5' for the least favoured / used. The responses to this question are illustrated in Figure 4.14.

Figure 4.14: Rankings in Order of Importance as an Aid in Clinical Decision Making



The top three information sources (ranked first) were colleagues (55.4%), paper-based resources (48%) and electronic full-text journals (45.1%). The least important and least used resource for clinical decision making was other health professionals (15.5%).

The responses to these statements were compared from acute-sector based doctors and those working in general practice. Ranking the most preferred response ("1") produced the results illustrated in Table 4.19.

Table 4.19: Ranking Comparisons of Acute- Sector and General Practice Doctors for their Preferred Aid in Clinical Decision Making

	Acute	GP
Colleagues	2nd	1st
EBM resources listed	4th	3rd
Full text electronic journals	1st	4th
Other health professionals	5th	5th
Textbooks or Journals (in paper format)	3rd	2nd

The only similarity in the rankings is placing "other health professionals" last. The major difference is the acute-sector doctors ranking "full-text electronic journals" first, whilst GPs placed these fourth. The GPs ranked "colleagues" as their first choice.

Ranking the top aid in clinical decision making by years since graduation produced the results shown in Table 4.20.

Table 4.20: Ranking Comparisons by Years of Medical School Graduation in Selecting the Preferred Aid in Clinical Decision Making

	1-10 years	11-20 years	21+ years
Colleagues	1st	2nd	2nd
EBM resources listed	2nd	4th	4th
Full text electronic journals	3rd	1st	3rd
Other health professionals	5th	5th	5th
Textbooks or Journals (paper format)	4th	3rd	1st

The marked change is in the use of paper resources (textbooks and journals) and EBM resources. Those who graduated over eleven years ago ranked the EBM resources listed in this research in fourth place, whilst those who graduated in the last ten years ranked this second. Doctors who graduated over twenty-one years ago ranked textbooks and journals (in paper format) first, whilst they were ranked fourth by those most recently graduated. Colleagues were still ranked favourably, first with those recently graduated and second by the others.

4.3.11 Question 13: Views and Attitudes towards EBM

This question on views and attitudes towards EBM asked whether responders agreed or disagreed with the following statements:

- Practising EBM improves patient outcomes;
- EBM requires critical appraisal skills to assess the quality of research;
- Busy doctors do not have the time to find and critically appraise the relevant research papers;
- EBM is a good concept that fails in practice;
- In most areas of medicine, there is little or no evidence to guide practice;
- The whole medical information "explosion" is overwhelming.

The results for this question are shown in Table 4.21.

Table 4.21: Percentage Responses to Views and Attitudes Towards EBM

	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
Improves patient outcomes	0.9%	2.1%	24.7%	57.6%	14.7%
Requires critical appraisal skills	0.3%	5%	8.8%	57.3%	28.6%
Busy doctors do not have time	4.5%	20.2%	11.7%	47.8%	15.8%
A good concept that fails in practice	3.3%	35.3%	31.6%	25.5%	4.3%
Little or no evidence to guide practice	8.1%	45.3%	16.3%	26.4%	3.9%
Medical information "explosion" overwhelming	3.1%	27.6%	14.9%	40.3%	14.1%

Respondents were positive (either "agree" or "strongly agree") about the statements on requiring critical appraisal skills (85.9%) and improving patient outcomes (72.4%).

Respondents also selected "agree" or "strongly agree for the following statement; however this was phrased in a negative manner. Therefore 63.6% felt that busy doctors do not have time to practice EBM

The "not sure" response can be construed as a "sit on the fence" response, alternatively this response suggests that the argument for and against the statement has not been decided by these individuals. 31.6% of respondents were "not sure" whether EBM is a good concept that fails in practice, whilst 24.7% were "not sure" if EBM did improve patient outcomes.

The responses to these statements were compared from acute-sector based doctors and those working in general practice. Three statements produced different results, as illustrated in Table 4.22.

Table 4.22: Differences in Attitudes and Views Towards EBM Between GPs and Acute-based Doctors

	Agree / Strongly Agree	
	Acute	GP
Requires critical appraisal skills	91.6%	77.8%
Busy doctors do not have time	54.5%	77.4%
Little or no evidence to guide practice	37.2%	21.8%

Comparing the results according to number of years since graduating medical school produced the results shown in Table 4.23. Respondents who had graduated from medical school recently were more positive about the practice of EBM and its effects on patient outcomes (82.4% agreed or strongly agreed) and were also more likely to believe that critical appraisal skills were a requirement for EBM (92.9%). Those who graduated more than twenty-one years ago were more likely to believe EBM fails in practice (31.6% agreed or strongly agreed).

Table 4.23: Differences in Attitudes and Views Towards EBM Between Those Who Graduated from Medical School in Different years

	Agree / Strongly Agree		
	1-10 years	11-20 years	21+ years
Improves patient outcomes	82.4%	77.5%	66.8%
Requires critical appraisal skills	92.9%	91.2%	81%
A good concept that fails in practice	23.5%	29.7%	31.6%

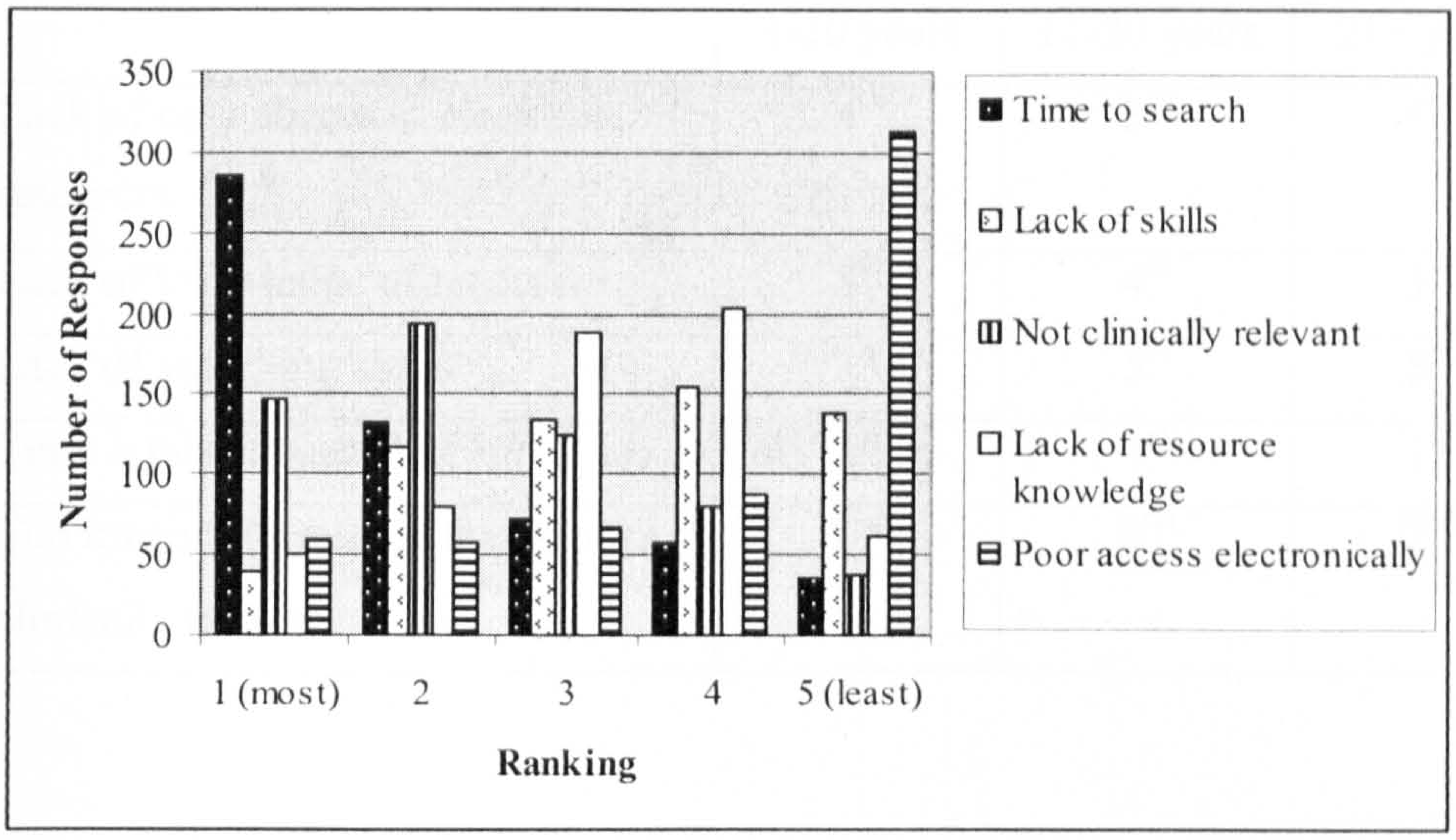
4.3.12 Question 14: Barriers to Accessing Electronic Health Information for Patient Care

This question asked respondents to rank in order (1 to 5, with 1 being the most important) their perceived barriers to accessing electronic health information for patient care. The five options presented were:

- Lack of easy access to electronic resources;
- Lack of knowledge of resources;
- Lack of searching skills;
- Time it takes to search;
- Too much information that is not clinically relevant.

Figure 4.15 illustrates the responses to this question. This graphically demonstrates that poor access to electronic resources was the least significant barrier, whilst the most significant barrier was the time required to search for information.

Figure 4.15: Ranking of Responses to Barriers to Accessing Electronic Information



Ranking the responses in order produces the following list:

1. Time it takes to search;
2. Too much information that is not clinically relevant;
3. Lack of knowledge of resources;
4. Lack of searching skills;
5. Lack of easy access to electronic resources.

The responses to these statements were compared from acute-sector based doctors and those working in general practice. The results were broadly similar except for the third and fifth rankings of perceived barriers. The GPs ranked "lack of knowledge of resources" third and "lack of easy access to electronic resources" fifth, whilst the acute-sector doctors ranked these the other way round (lack of access third and lack of knowledge fifth).

Ranking the results according to number of years since graduating medical school produced the results shown in Table 4.24. The "time it takes to search" was the top ranked barrier for all respondents, followed by "too much information that is not clinically relevant". Those most recently graduated ranked a "lack of searching skills" third, whilst those who graduated earlier ranked this last.

Table 4.24: Comparing Ranked Responses to Barriers to Accessing Electronic Information According to Years Since Graduation from Medical School

	1-10 years	11-20 years	21+ years
Lack of easy access to electronic resources	4th	3rd	4th
Lack of knowledge of resources	5th	4th	3rd
Lack of searching skills	3rd	5th	5th
Time it takes to search	1st	1st	1st
Too much information that is not clinically relevant	2nd	2nd	2nd

5 Discussion

The discussion chapter considers the results according to the objectives outlined in this introduction.

5.1 Information Needs

5.1.1 Quantifying the Information Needs of UK Doctors

5.1.1.1 Identified Need

The results from this research fit within the range of findings from previous research, falling in the lower end of the range (Table 5.1).

One of the clinical librarians e-mailed that discussing the results from this research "We think we actually get more questions raised with us via email and telephone than in person" (Lawrence, 2007). This suggests that even though the figure for this research for the number of questions asked per patient is 0.24 or approximately one question for every four patients, in reality this figure is probably higher. Only questions generated during the ward round or clinical meeting have been counted. Those questions generated on reflection and asked at a later date in a different format (face-to-face, telephone, e-mail, internal post) have not been counted in this research. This is potentially a limitation of this data collection method as the number of questions recorded does not accurately reflect the total number of questions generated. Therefore these figures may not reflect all the clinical information needs of doctors.

The three non-USA studies (Van Duppen et al., 2007; Arroll et al., 2002; Barrie & Ward, 1997) had similar results to the UK results in this research. This perhaps reflects the similar nature of the healthcare services in these countries. These results also suggest when comparing studies, researchers in the UK should consider work from New Zealand, Australia and Western Europe rather than the USA.

There was no correlation between the work areas of primary and secondary care. Nor was there any correlation between the methodologies used to collect the data.

Table 5.1: Number of Clinical Questions per Patient Encounter

Author, Date	Country	Methodology	Doctor's Work Area	No. of Patient Encounters	No. of Questions	Questions per Patient
Fozi et al., 2000	Malaysia	GPs submitted questions	Primary	7101	78	0.01
Ely, Burch & Vinson, 1992	USA	Observation	Primary	602	41	0.07
Van Duppen et al., 2007	Belgium	GP searched for information	Primary	2920	365	0.13
González- González et al., 2007	Spain	Observation	Primary	3511	635	0.18
Barrie & Ward, 1997	Australia	Interview after clinical session	Primary	376	85	0.23
Karen Davies, 2008	**UK**	**Clinical Librarians Log**	**Secondary**	**1210**	**286**	**0.24**
Arroll et al., 2002	New Zealand	Observation	Primary	420	122	0.29
Ely et al., 1999	USA	Observation	Primary	2467	778	0.32
Dee & Blazek, 1993	USA	Patient charts	Both	144	48	0.33
Cogdill et al., 2000	USA	Interview after patient visit	Primary	148	62	0.42
Ebell & White, 2003	USA	Post visit interview	Secondary	966	415	0.43
Gorman & Helfand, 1995	USA	Interview after patient visit	Primary	514	295	0.57
Covell, Uman & Manning, 1985	USA	Post visit interview	Both	409	269	0.66
Green, Ciampi & Ellis, 2000	USA	Interview after patient visit	Primary	401	280	0.70

Author, Date	Country	Methodology	Doctor's Work Area	No. of Patient Encounters	No. of Questions	Questions per Patient
Ramos, Linscheid & Schafer, 2003	USA	Observation	Secondary	215	274	1.27
McCord et al., 2007	USA	Observation	Primary	328	532	1.6

A comparison not undertaken in previous research was to determine the number of questions asked per doctor. Comparisons could only be undertaken with previous studies that specified the number of doctors who participated in that study. This is the first time that such a comparison has been undertaken.

In this research doctors asked fewer questions. This possibly reflects the context of this research with patient cases being discussed by a medical team (with several doctors). Whereas previous research investigated in the more traditional settings with an individual doctor treating one patient at a time. This is illustrated in the responses in Table 5.2, which divided the number of questions asked by the number of doctors. This research involved a much larger number of doctors than other studies due to the "group" nature of the information gathering arena. In contrast the Van Duppen et al. (2007) study only had a sample size of five doctors, which may account for the high questions per doctor figure.

Table 5.2: Number of Clinical Questions per Doctor

Author, Date	Country	No. of Doctors	No. of Questions	Questions per Doctor
Karen Davies, 2008	**UK**	**655**	**286**	**0.44**
Ely, Burch & Vinson, 1992	USA	30	41	1.34
Arroll et al., 2002	New Zealand	50	122	2.44
Barrie & Ward, 1997	Australia	27	85[15]	3.15
Dee & Blazek, 1993	USA	12	48	4
Cogdill et al., 2000	USA	15	62	4.13
González- González et al., 2007	Spain	112	635	5.67
Covell, Uman & Manning, 1985	USA	47	269	5.72
Gorman & Helfand, 1995	USA	49	295	6.02
Ramos, Linscheid & Schafer, 2003	USA	38	274	7.21
Green, Ciampi & Ellis, 2000	USA	34	280	8.24
Ely et al., 1999	USA	103	1101	10.69
Ebell & White, 2003	USA	27	415	15.37
McCord et al., 2007	USA	23	532	23.13
Van Duppen et al., 2007	Belgium	5	365	73

5.1.1.2 Unidentified Need

When doctors are unaware there are gaps in their knowledge, this need can be classified as unidentified. This research categorizes the unidentified need as those questions identified by Clinical Librarians, but not specifically identified by the doctors themselves.

[15] Clinical questions only – total questions asked 119, including 28 organisational, 4 patient data and 2 ethical dilemmas.

Figure 5.1: Relationship between the concepts need / wants / demand / use and the Impact of the Clinical Librarian (adapted from Lor, 1979, p.6)

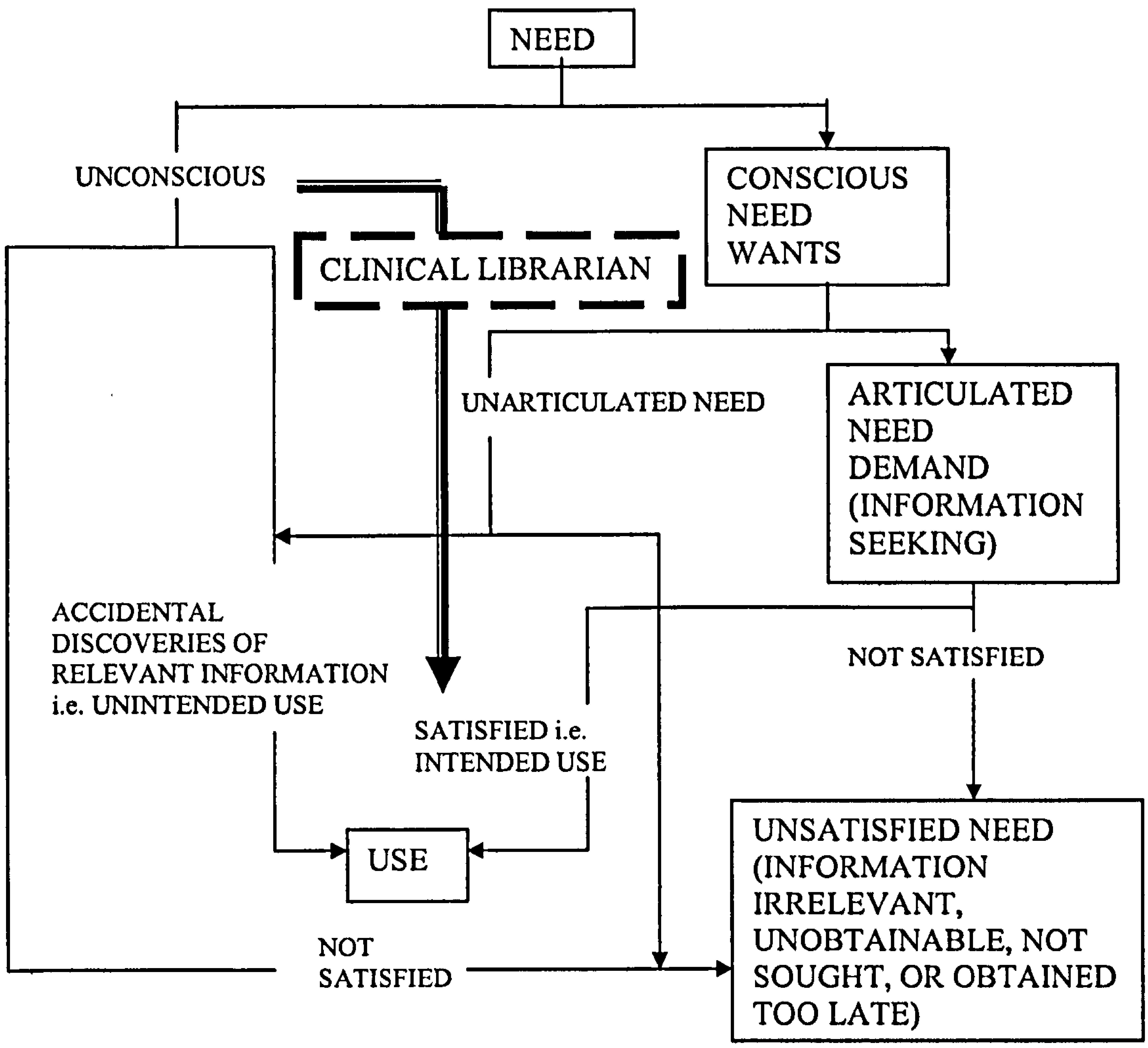


Figure 5.1 illustrates the conscious (then acted upon) need and the unconscious or unidentified need (Lor, 1979). The figure has been adapted to include the role of the clinical librarian and the impact this has on the unidentified or unconscious needs of doctors in the clinical setting. The clinical librarian can identify the "unconscious" needs of doctors and answer that unknown demand for information that could then be "used" by the doctor.

Over 70% of the research methods involved self-reporting in some form by the doctors; commonly by interview. However, asking a doctor to recall questions will not identify questions of which the doctor is unaware, that is, the "unconscious" need.

Two previous studies have identified that doctors' perceived need for information was lower than their actual need (Ebell & White, 2003; Covell, Uman & Manning, 1985). This highlights the fact that doctors do have unidentified or unperceived information needs. The study by Covell, Uman & Manning (1985) identified a large discrepancy as the doctors' perception of their frequency of information needs, self-reported by questionnaire, was on average once per week, whilst the post-patient interview produced an average of two questions for every three patients seen. Ebell & White also found that interviews after the patient visit identified more questions (0.42) than self-reporting by doctors (0.16).

This research identified the unperceived information need as 0.01 question asked per patient or one question for every 100 patients. This figure is lower than those from Ebell & White (2003) and Covell, Uman & Manning (1985). This is not surprising as the doctors were not asked to articulate every question they mentally considered. Also as this research was undertaken within medical teams with groups of doctors rather than individual doctors (as the other studies) then one doctor may verbally ask the question that other doctors were actually thinking, but this would only count as one question.

5.1.1.3 Information Use

Ely, Burch & Vinson (1992) focused on information-seeking behaviour rather than question-asking behaviour. The observer focussed on questions that occurred for which answers were pursued. The finding from this study was that an average of 0.07 questions were asked per patient.

In this research "information use" was a clinical question identified by the doctor and considered of such importance that the clinical librarian was asked to follow up on it. Many questions (223) were raised by doctors, but were not followed up by the clinical librarian. Some of these questions may have been answered through subsequent discussion in the meeting. Other questions may have been of general interest, but not pertinent nor worth following up for this particular patient case. This research found a similar figure to the Ely, Burch & Vinson (1992) study, with an average of 0.05 questions asked per patient.

5.1.2 Types of Information Needs of UK Doctors

5.1.2.1 Total Responses

Nearly a quarter of doctors responded that they did not use electronic resources for treatments for common diseases and a fifth did not use electronic resources for drug information. This is probably because in some respects the traditional or paper version of a resource such as the BNF is just as useful. One GP wrote "I'm not in the habit of using the computer version. The paper version of BNF is quicker as I don't have to move between computer screens" [Dr S.].

Information on rare diseases and syndromes was accessed using electronic resources by over a quarter "all the time". This is because the most up-to-date information is required which is not always the case with paper resources. The availability of exotic holiday travel destinations and immigration mean that conditions that were not previously seen in the UK, can now occur, e.g.:

- Approximately 2,000 cases of malaria occur each year in the UK (http://www.hpa.nhs.uk/infections/topics_az/malaria/menu.htm);
- In 2003 a man died in Scotland from rabies, probably from bats, whilst the other twenty-two deaths since 1946 were infected abroad (http://www.hpa.org.uk/infections/topics_az/rabies/menu.htm);
- Severe Acute Respiratory Syndrome (SARS) (http://www.hpa.org.uk/infections/topics_az/SARS/menu.htm).

The least popular reason for accessing electronic resources was to gather information for further qualifications. The average number of years since respondents had graduated from medical school was twenty-one years. Therefore these doctors are likely to be quite senior and to have already gained all the qualifications they require. The importance of CPD (or keeping up-to-date) and thus maintaining skills / knowledge is therefore understandable as the medical field is a rapidly changing environment.

5.1.2.2 Comparing Acute-Sector Doctor to GP Responses

The top category of questions for both groups was treatment. However acute-sector doctors then asked diagnosis questions followed by management, whilst GPs asked management questions followed by diagnosis. This illustrates the long-term patient care focus of GPs, compared to the more condition-focus of acute-sector doctors who treat the condition/symptom and then discharge the patient from their care. Double the numbers of epidemiology questions were asked by acute-sector doctors compared to GPs. The acute-sector doctors are more likely to initially diagnose a patient. The follow-up question from the patient may be to ask about the prognosis or risks associated with their diagnosis. This then leads to more epidemiology questions from acute-sector doctors.

The ratio of diagnosis to treatment is approximately 1:2 for acute-sector doctors which was nearly double that for GPs. This ratio illustrates that diagnosis is more common in the acute-sector than general practice.

GPs were less likely to access electronic information for rare diseases and syndromes. GPs in the UK are more likely to refer unusual patient cases (with rare diseases and syndromes) to specialists in the acute-sector for diagnosis.

GPs were less likely to access electronic information for research or for teaching purposes. Traditionally more teaching is undertaken within hospitals. GP training practices develop the skills of trainee general practitioners. In the UK approximately one third of general practices, 3,900, are involved in community-based undergraduate medical education (Royal College of General Practitioners, 2006). However these train a much smaller number of GPs than the 175 NHS Acute (hospital) Trusts train HOs / SHOs (NHS Confederation, 2007).

GPs were more likely to access electronic resources to provide information to give to patients. GPs are the first port of call for patients and manage long-term care. A key role is preventative medicine through vaccination, screening and prescribing prophylactic drugs. Linked to this is patient education and a key element of this is patient leaflets (many of which are downloadable via the Internet). Dr M stated the key electronic resource used was "PDF patient information leaflets". Another GP (Dr S.) stated that this was their "main" reason for accessing electronic information, specifically mentioning the resource Health First for leaflets on Sexually Transmitted Infections (http://www.healthfirst.org.uk/publications/hf_publications.htm).

Analysis of the results using the taxonomy developed by Ely, when compared between the UK General Practitioners and Acute-sector based doctors produced similar results, especially in the top categories.

The top diagnosis category for both groups of doctors was 1.3.1.1 (test – indications). These questions relate to whether a particular test is indicated or suitable in a certain situation. This is a frequently asked question in the UK as doctors want to ensure that no new tests have been developed that are more cost-effective, quicker, reliable and patient-friendly. Developments and advancements are so rapid that it is impossible to keep-up-to-date, thus the need to ask questions before using the test. This suggests a commitment to EBM.

The top two treatment categories were the same for both sets of doctors, 2.2.1.1 (not limited – treatment) and 2.1.2.1 (drug prescribing – treatment). These questions relate to treatment (either drug or intervention) and combined account for nearly one quarter of all GP questions (24.5%) and over a third (35.6%) of those from acute-sector doctors. The category 2.2.1.1 asked how a particular condition or finding should be treated (though not necessarily by prescribing drugs). This may well be to ensure that any new treatments are identified. Category 2.1.2.1 considered which drug should be used in a particular situation or condition. Some pharmaceuticals have been developed for a particular condition, but evidence later suggests that the same drug may be suitable in treating another condition or finding. Two examples of this are:

- Metformin is used for treating type 2 diabetics by lowering blood glucose (sugar). However it has also been used as to treat polycystic ovary syndrome (http://www.mayoclinic.com/health/drug-information/DR202756);
- Thalidomide is used to treat and prevent Erythema Nodosum Leprosum (ENL), a skin disease associated with leprosy. In the 1960s the drug was used to treat morning sickness, but unforeseen birth defects occurred (http://www.mayoclinic.com/health/drug-information/DR601319). The Lancet published an article by Facon et al. (2007) that suggested combining Thalidomide with other drugs could improve survival in elderly patients with multiple myeloma.

Therefore doctors in the UK are likely to ask questions in this category to ensure they use the most suitable drug for that patient (based on the latest evidence). Questions in both categories suggest doctors are committed to EBM in practice.

The top management category for both GPs and acute-based doctors was 3.1.1.1 (condition). There has been a focus in the UK on National Service Frameworks (NSFs), guidelines and care pathways to ensure patient care is based on the best available evidence and to standardise patient care across the country (http://www.library.nhs.uk/pathways/SearchResults.aspx?catID=7584). Therefore doctors are likely to ask questions on managing conditions, findings and situations to ensure they treat a patient with the latest evidence.

Two of the top three categories in the non-clinical section were the same for both acute-sector doctors and GPs. These were 5.1.1.1 (provider – continuing medical education) and 5.1.1.2 (provider – information provider). This suggests that doctors have embraced the ethos of "lifelong learning" and are keen to update their knowledge. However the fact that so many questions were asked about the information providers suggests that doctors do not have the knowledge or skills to locate the information themselves. Therefore doctors may need to be taught both the skills to search information sources and awareness of the information sources themselves.

Analysis of the results from the clinical questions when compared between the UK General Practitioners and Acute-sector based doctors does produce different results in certain categories. There were also a number of categories with responses only from GPs or acute-sector doctors. Whilst the figures and corresponding percentages are not significant, they are still worth recording.

Acute-based doctors asked more questions in the 1.2.1.1 (manifestations of the condition) diagnosis category whilst more GPs asked questions on 1.3.2.1 (accuracy of the test). GPs treat patients long-term and face the repercussions of patients returning with unsatisfactory test results. Whilst acute doctors would also have to see the patient again, this would just be short-term, until the patient or condition has been treated. The GP however will have the patient on their books, potentially for the life of the patient.

There were two diagnosis categories with no GP questions. These were 1.3.4.1 (test – preparation) and 1.6.1.1 (inconsistencies). This is not unexpected as GPs refer patients they are not able to diagnosis themselves to the acute-sector specialists for diagnosis by experts.

One diagnosis category had no acute sector questions, 1.7.1.1 (diagnosis – cost) GP 0.2%. Whilst acute-sector doctors must be aware of the costs of treating one patient to the detriment of others, this is more of an issue with GPs, especially if they are fund-holders.

Two treatment / drug prescribing categories have no acute-sector doctor questions. 2.1.7.1 (physical characteristics, GP 0.6%) and 2.1.12.1 (availability, GP 0.6%) reflect the dynamic nature of the pharmaceutical industry. Specialists in the acute sector are likely to keep up with developments in their area (so therefore no questions in these two categories), but the more generalist GP would not be able to keep-up-to date with pharmaceutical developments across all medical specialisms. Therefore when a patient presents with a treatment programme from the hospital that the GP does not recognise, this could lead to questions on the physical characteristics and availability of the pharmaceutical.

Category 3.3.3.1 (management – doctor-patient communication – patient compliance) received 0.4% questions from GPs and none from acute-sector doctors. It is not surprising that acute-sector doctors had no questions in this category since patients are less likely to challenge a hospital "expert" compared to the more generalist GP. GPs also manage patients with life-long conditions such as Type II diabetics and those with high cholesterol. Often with such conditions life-changing steps can improve the conditions such as improved diet and more exercise. However, encouraging patients to undertake such dramatic changes to their lifestyle is problematic. Therefore GPs in particular are concerned with patient compliance, as well as finding methods of encouraging and supporting patients to embrace healthier lifestyles.

One management category had no GP questions; 3.3.6.1 (doctor-doctor communication / how to do it) Acute 0.3%. In fact this category could have questions from either doctor sector as communication between doctors in different medical sectors such as primary and sector is considered to be inadequate. Campbell et al. (2004) analysed letters between GPs and specialists. That research determined that to improve communication the desirable content of letters should be defined to improve consistency.

The top epidemiology category for acute-based doctors was 4.3.1.1 (course), whilst for GPs the top category was 4.2.1.1 (aetiology – causation – risk factors). When a patient is first diagnosed with a condition, that is the point they are likely to ask "what does that mean?" and "what may happen?" Therefore, the acute-sector doctor is likely to prepare themselves by researching the usual course of a condition. Whereas the GP focus on the long-term management of patients, so will consider risk factors of conditions, to possibly initiate prophylactic treatments.

The result of 0.2% from the acute-sector (and none from GPs) for 4.2.1.2 (epidemiology – aetiology – causation – genetics) is not unexpected. Genetics is an acute-sector specialism that is important, but not part of the main-stream.

There was one difference between the top three education categories between GPs and acute-based doctors. This was the category of 5.1.1.3 (provider – trainee) for acute-sector doctors and the administrative (5.2.1.1) category for GPs. This reflects the teaching nature of the hospital setting and the fact that GPs may be managed (administered) by the GPs themselves.

One non-clinical category had no GP questions; 5.4.1.1 (non-clinical – legal) Acute 0.1%. The question was "what legislation relates to safety and security of parents and their babies?" The fact that no question was posed by GPs in this research is probably due to the small number of questions investigated rather than there never being a need to ask this type of question.

The acute sector doctors had no questions for three categories in the non-clinical section (5.1.2.1, 5.8.1.1 and 5.10.1.1).

The category 5.1.2.1 (education – patient) received 0.6% questions from GPs. GPs are usually involved with prevention (including screening), patient management and related to these, patient education. For example, female patients are screened for cervical cancer through their GPs. Patients, who fail to comply, are sent follow-up letters which contain information regarding the test and why it is necessary.

The acute sector doctors had no questions for the category 5.8.1.1 (religion / culture). This may reflect the old argument that acute-doctors focus on the condition and GPs on the patient.

The category 5.10.1.1 (non-clinical – IT / Internet) had GP 0.7% questions. This is not because these issues do not affect hospital doctors, but because GPs are more likely to be autonomous and run their own "business". Since GPs manage their practices they are the implementers and enforcers of Internet and IT policies, hence the need to ask questions in this area.

Comparing the top ten categories for GPs and acute-based doctors to the combined totals produced differences. These highlight the difference between GPs and acute-sector doctors. Both categories listed 1.3.2.1 (diagnosis – test - accuracy), but in total there were not enough responses to be included in the combined top ten. Another four GP categories were not listed in the overall top ten: 2.1.1.3 (treatment - drug prescribing – how to prescribe); 2.1.2.2 (treatment – drug prescribing – drug of choice - prevention); 2.1.3.3 (treatment – drug prescribing – adverse effects) and 3.2.1.1 (management – practices of other providers).

The three treatment questions ranked by GPs are all related to drug prescribing. Doctors in the acute sector are specialists in their particular area and are able to keep up-to-date with the latest treatment developments as the field is smaller than that faced by the more generalist GPs. Therefore GPs are more likely to ask questions regarding how to prescribe particular drugs (2.1.1.3). GPs are generally the first contact point for patients. Therefore GPs are more likely to encounter patients at a stage when preventative measures may prevent problems developing. This explains the high ranking of 2.1.2.2 which refers to questions such as "Should this kind of patient get prophylactic drug x to prevent condition y?" GPs usually monitor and manage the long-term care of patients and therefore are more likely to ask questions about adverse effects (2.1.3.3) of pharmaceuticals as they manage the whole patient whilst acute-sector doctors just focus on the one condition in their specialism that the patient suffers from.

The GP high ranking of questions concerning the practices of other providers (3.2.1.1) is understandable as GPs are more likely to be managing patients long-term so will be more interested in how others are managing certain conditions and patients.

The acute-based doctors ranked diagnosis categories in fourth, sixth and eighth places compared to the treatment categories of GPs. This reflects the different focus of these two groups. The focus of general practice is general patient well-being and a major aspect of that is long-term treatment or patient management. Whilst the acute-sector doctors their key role is in diagnosis, though treatment usually subsequently follows.

In total there are seventy-four categories in the combined UK and Ely et al. (2000) taxonomy. There were no questions from one of the doctor groups (either GP or Acute doctors) for eleven of the categories or 14.9% of the total categories and no questions from both for thirteen categories (17.6%).

5.1.2.3 Responses Compared by Years Graduated from Medical School

The longer doctors had been graduated from medical school the less likely they were to access information electronically to study for further qualifications. Doctors spend the early part of their careers gaining the relevant qualifications and progressing through their Royal College's career ladder, from Senior House Office to Specialist Registrar to Consultant. Once established as a consultant the focus then turns to continuing professional development, rather than gaining qualifications per se.

5.1.2.4 Comparison of UK Doctors' Results to Other Research

Basic analysis suggests that the top categories are treatment or therapy (average 41.1%), diagnosis (24.8%) and drug therapy / information. In this research doctors were asked if they used electronic resources to locate information for specific purposes, "all the time", "sometimes" and "never". Ranking the top five patient-care related reasons doctors used "all the time" produced the following:

1. Information on rare diseases and syndromes;
2. Information to give to patients;
3. Information to assist with diagnosis;
4. Drug information;
5. Treatment options for common diseases.

Comparison is problematic due to the different categories utilised. However, the order is roughly the same after the additional need of "information to give to patients" is eliminated, assuming that the information on rare conditions also includes treatment.

The analysis of clinical questions using the taxonomy developed by Ely et al. (2000) identified several questions which would have been categorized as "not elsewhere classified". This is because these questions did not fit into any of the categories identified by Ely et al. (2000). These initial categories were corroborated later by González-González et al. (2007). However, the questions not classified in this research could actually be grouped into new categories, as illustrated in Table 5.3. This represents an adaptation of the Ely et al. (2000) taxonomy and is significant in terms of the literature and clinical practice.

Table 5.3: Additional Categories Inserted into Ely et al.'s (2000) Taxonomy

Code	Primary	Secondary	Tertiary / Quaternary	Generic type
2.2.5.1	treatment	not limited to but may include drug prescribing	adverse effects / findings	Could finding y be caused by non-drug treatment x? OR Does non-drug treatment x cause finding y? OR What are the adverse effects of (or risks of using) non-drug treatment x? OR What is the likelihood (incidence) of adverse effect(s) y resulting from non-drug treatment x? OR How long do the adverse effects from non-drug treatment x last after stopping it? OR Which non-drug treatment has the fewest adverse effects? OR Are there differences among non-drug treatment x1, x2, ... xn in their likelihood of causing adverse effect(s) y?
2.2.5.2	treatment	not limited to but may include drug prescribing	adverse effects / safety / contraindications	Is non-drug treatment x safe to use in situation y? OR Is non-drug treatment x contraindicated in situation y?
2.2.7.1	treatment	not limited to but may include drug prescribing	cost	What is the cost of non-drug treatment x? OR How does the cost of non-drug treatment x1 compare with the cost of non-drug treatment x2, x3, ... xn?
3.3.4.1	management (not specifying	doctor-patient communication	views / attitudes	What are patients' views / perceptions of situation z? OR What are

	diagnostic or therapeutic)			the attitudes of patients / relatives to condition y / situation z? OR What patient satisfaction questionnaires are there on condition y / situation z? OR What are patients reactions to condition y?
3.3.5.1	management (not specifying diagnostic or therapeutic)	doctor-doctor communication	how to do it	How should I communicate with other doctors in situation z?
3.3.6.1	management (not specifying diagnostic or therapeutic)	doctor-patient communication	screening	What guidelines are there on screening for condition y? OR Is there an impact on situation z from screening for condition y? OR What are the benefits and cost-effectiveness of screening for condition y?
5.7.1.1	non-clinical	Ethnicity		Are there ethnic differences in recovery from condition y? OR Are there different usages of healthcare services by ethnic groups? OR Does ethnicity affect the progress of condition y / situation z?
5.8.1.1	non-clinical	Religion / Culture		What cultural / religious considerations should be given before treating condition Y? OR Do any health care actions require cultural / religious consideration?
5.9.1.1	non-clinical	Statistics		What are the national statistics for condition y / situation z? OR Where can statistics be located on condition y?
5.10.1.1	non-clinical	IT / Internet		What are good Internet access policies? OR What Internet sources are there for information on condition y / situation z?

5.1.2.5 Comparison of Acute-Sector Doctors Results to Other Acute-Sector Research

The results from this research were compared to previous research. Various terms have been used to classify the information needs of doctors. To enable comparison with this research the various terms have been mapped, where possible, to the terms used in this research. Diagnosis included "choice of diagnostic investigations" and "choice of laboratory tests". The category treatment included "adverse effects of treatment", "drug information" and "prevention". Four management terms included were "referral", "monitoring", "screening" and "advice given to patients". Epidemiology included "prognosis" and "aetiology". Non-clinical included the "general review of topic" and "administration". However, since the definition of the criteria for each term is only known by the original researcher(s) amalgamating the results in this manner may in fact skew the results. This may partly explain the range of results presented in Table 5.4 (and also Table 5.5).

Table 5.4: The Type of Information Required by Acute-Sector Doctors

	Diagnosis	Treatment / Therapy	Management	Epidemiology	Non-clinical
Ali, 2000	24.4%	12.2%	47.5%	0	0
Green, Ciampi & Ellis, 2000	25%	47.1%	0	22.1%	1.8%
Crowley et al., 2003	22%	53%	0	18%	0
Cheng, 2004 (doctors results only)	7%	46%	0	0	0
Schilling et al., 2005	18.4%	51.9%	13.3%	7.6%	0
Karen Davies, 2008	**20.5%**	**48.6%**	**12.4%**	**10.3%**	**8.1%**

Table 5.4 shows that all the results are similar to the other research for diagnosis and treatment, except those reported by Ali (2000) and Cheng (2000). Comparison with Cheng is problematic as not all the results for doctors were mentioned in the article. The Cheng article was also based on research in Hong Kong which is predominantly a hospital-based medical structure with limited "UK-traditional" primary care facilities. The Ali (2000) study focused on doctors asking for information to answer questions for "diagnosis" of clinical cases and not for general patient care, as with this research.

The VALUE project evaluated the responses of eleven hospital-based doctors. The study identified a ratio of 1:2 for diagnosis to treatment since 53% of the questions were on treatment and 27% diagnosis (Urquhart & Hepworth, 1995). The acute-sector doctors in this research had a similar ratio as 48.6% of the questions were on treatment and 20.5% diagnosis.

Researchers analysed doctor's patient care questions from the Emergency Department (A&E) in the USA (Graber et al., 2007). The top two diagnosis categories matched those reported in this research, as did one of the treatment categories. However, research in A&E ranked highly the category 2.1.1.2 (treatment - drug dosage), which was rarely asked in the UK acute-sector. This difference may be because the UK research considered the acute-sector in its entirety, not by individual specialisms, such as A&E.

5.1.2.6 Comparison of GPs' Results to Other GP Research

A survey of general practices in the Northern and Yorkshire region found GPs used NHSnet for research, to locate guidance and find patient information (Wilson, Glanville & Watt, 2003). In this research the top three reasons that GPs searched for evidence was information for patients, information on rare diseases and syndromes, followed by continuing professional development. Research was ranked last. This suggests that the GPs in this research were committed to using electronic information for patient-care.

Table 5.5: The Type of Information Required by General Practitioners

	Diagnosis	Treatment / Therapy	Management	Epidemiology	Non-clinical
Chambliss & Conley, 1996	37%	52%	0	6%	0
Codgill et al., 2000 (no student present)	22.6%	29%	12.9%	24.2%	1.6%
Ely et al., 2000	37.6%	43.8%	9%	5.9%	3.7%
Fozi et al., 2000	47.1%	35.3%	0	5.9%	0
Swinglehurst, Pierce & Fuller, 2001	23.3%	66.7%	0	10%	0
Arroll et al., 2002	33%	39%	6%	0	21%
Ebell & White, 2003 (doctors self-reporting)	23.1%	57.7%	5.7%	5.7%	7.7%
Schwartz et al., 2003	8.7%	60.9%	0	27.2%	3.3%
Alper, White & Ge, 2005	22%	51%	3%	11%	0
Bergus & Emerson, 2005	50%	38.1%	0	7.4%	4.6%
Magrabi et al., 2005	40%	43%	10%	7%	0
González-González, et al., 2007	52%	26.8%	7.3%	1.1%	12.8%
Van Duppen et al., 2007	21.5%	70.1%	0	8.4%	0
Karen Davies, 2008	**14.3%**	**53.3%**	**16.3%**	**5.4%**	**10.7%**

Table 5.5 analyses the different types of information required by GPs. The results from this research are similar to van Duppen et al. (2007), Alper, White & Ge (2005), Schwartz et al. (2003) Ebell & White (2003) and Swinglehurst, Pierce & Fuller (2001). All but Alper, White & Ge (2005) were self-recordings of questions by doctors, as was the case with this research. The relevance that doctors place on these questions is higher as these are questions that doctors actually want answered. The difference between the two groups reflects the difference between an explicit need (doctor is aware of the information need (Braun et al., 2007)) and a pursued need (where information is actually sought to answer the need (Gorman, 1995)).

Ely et al.'s taxonomy (2000) was generated by classifying clinical questions from primary care doctors. These results were compared with the findings from the general practitioners in this research.

Analysis of the results from the clinical questions when compared between the UK General Practitioners and Ely et al.'s (2000) Primary Care doctors does produce different results in certain categories. These are illustrated in the tables in Appendix VI.

In the UK, GPs are more likely to refer patients to the acute-sector for diagnosis. This reflects the questions for 1.1.1.1 (cause / symptom) Ely et al. (2000) 8.2% to UK 2.2%, 1.1.2.1 (cause / sign) 4.8% to 1.9%, 1.1.3.1 (cause – test finding) 4.6% to 0.2% and 1.1.4.1 (cause – unspecified findings) 3.7% to 0%. This also explains why test categories produced similar results, 1.3.1.1 (test / indications) Ely et al. (2000) 8% to UK 2.4% and 1.3.4.1 (test – preparation) 0.2% to 0%.

The diagnosis categories 1.4.1.1 (name finding – body part) Ely et al. (2000) 0.6%, 1.4.2.1 (name finding – condition) 0.4% and 1.4.3.1 (name finding – test) 0.1% had no UK GP questions. These are all memory-refresher categories related to diagnosis, which is more-often undertaken in the acute sector in the UK.

UK GPs had no questions in the categories 1.5.1.1 (orientation / condition) and 1.6.1.1 (inconsistencies). This reflects the fact that in the UK, acute doctors are more likely to diagnose patients than GPs.

The treatment category 2.1.1.2 (drug prescribing - how to prescribe - dosage) received more questions from Ely et al. (2000) 6.7% than the UK 2%. There are two possible explanations for the differences in questions. Firstly the UK GP may automatically check the BNF (the drugs text British National Formulary) during the consultation so answered the question before actually voicing it. Alternatively in the UK, a GP is unlikely to prescribe a new drug without receiving full information from the pharmaceutical representative, which should have covered any potential questions likely to be raised during patient care.

UK GPs asked more questions on "drug prescribing adverse effects / safety" than those analysed by Ely et al. (2000). This may reflect the importance of Clinical Governance and Risk Management in the UK.

UK GPs asked more questions on the "efficacy" of treatments not limited to drug prescribing than those analysed by Ely et al. (2000). This may reflect the difference between a patient (or insurance) funded healthcare system and state-funded system. In the NHS accountability has to be taken by doctors on the treatments they prescribe, especially if these are "alternative" treatments such as acupuncture since funding is from a central point for all patients. Whereas in the USA, patient treatment costs are met by that individual patient (or insurance) so other treatments may be tried to determine if they work for that individual, rather than be concerned about their effects on the "average" patients.

UK GPs asked more questions on drug prescribing "timing" and "how to do" treatments not limited to drug prescribing than those analysed by Ely et al. (2000).

The management category 3.1.1.1 had more UK GP questions (8.9%) compared to Ely et al. (2000), 4.8%. This highlights the importance in UK general practices of long-term patient management. First the patient visits the GP who, if applicable, refers the patient on to the hospital consultant for further tests / diagnosis /

treatment. Once the consultant at the hospital has completed the diagnosis and treatment, the patient is referred back to the general practitioner for ongoing care management. The GP may have to update their knowledge of the condition to be able to manage their patient care effectively. This links directly with the next difference, 3.3.1.1 (doctor/patient communication – how to advise) with results of GP 1.7% to Ely et al. (2000) 0.6%. Since GPs are more likely to be managing patients long-term they are obviously more likely to ask questions on how to advise patients, particularly with questions on locating patient information leaflets. Since there is more information-sharing, then it is not surprising to find less patient compliance questions (3.3.3.1) asked in the UK (0.4% to Ely et al. (2000) 1.5%).

The category 3.2.1.1 (management - other providers / practices) had slightly more UK questions (GP 2.6%, Ely et al. (2000) 0.9%) and was ranked in the top ten for UK GP questions. This may be due to the recent culture in the UK to promote and disseminate "best practice", which has encouraged GPs to look at the practices of others. The NHS Beacon programme, launched in 1999, is an example of this (Department of Health, 1999). An example of this project is a GP practice in Croydon that achieved NHS Beacon status for Information Management and Technology due to its integration of technologies to support clinical development (Dr Namasivayam & Partners, [n.d.]).

The UK responses are higher for the non-clinical categories 5.1.1.1 (Education / Provider / CME) and 5.1.1.2 (Education / Provider / Information Provider). This suggests that UK GPs are less knowledgeable and confident on how and where to look for information themselves.

All of the questions in this research were classified. Therefore there were no questions for the categories 1.8.1.1, 2.3.1.1, 4.4.1.1 and 5.6.1.1 from UK GPs as these categories were for questions "not classified elsewhere".

Analysing the questions identified eleven additional categories to those originally classified by Ely et al. (2000). Obviously for each of these categories there are no questions from the Ely et al. (2000) study.

In total there are sixty-four categories in the Ely et al. (2000) taxonomy, plus the additional eleven categories identified in this research, producing a total of seventy-five. There were no questions from one of the studies (either UK or Ely et al. (2000)) for twenty-five of the categories, representing 33.8%. This is over double the figure when comparing the data from UK GP to UK acute-sector doctors (17.3%). This suggests there is more correlation between country and medical structure within that country than there is between the same medical disciplines in different countries.

5.2 Information-Seeking Behaviour

5.2.1 Preferences of Doctors in Locating Evidence

5.2.1.1 Total Responses

Respondents were asked to rank resources in order of importance as an aid in clinical decision making. The top information source was colleagues. Colleagues are a convenient, easy-to-access resource, but in terms of EBM should not be ranked highly in terms of clinical decision making. This suggests that EBM in practice is not embraced as fully as doctors perceive. In some specialisms, the evidence base is not sufficient so asking colleagues instead is logical. One respondent confirms this with their e-mailed comment:

> "I work in children's orthopaedics. The evidence base is pitiful for a number of reasons, which is why one tends to seek advice of colleagues on difficult clinical problems. If I were a physician I suspect my answers to some of your questions would have been different because the evidence base is so much bigger." [Dr RD].

Respondents were asked how they currently accessed electronic information at work and how they would like to access this information. The wireless laptop, PDA and mobile phone SMS were all methods of accessing information that twice as many respondents would like to use than they currently do. This suggests that some doctors are keen to embrace new technologies.

5.2.1.2 Comparing Acute-Sector Doctor to GP Responses

However when comparisons were made between two different sectors that doctors work in, distinct differences were highlighted that show that colleagues were not the most popular resource for all doctors.

The acute-sector doctors ranked "full-text electronic journals" first, whilst GPs placed these fourth. This reflects the specialist nature of acute-sector doctors who are unlikely to have colleagues in the same hospital who are experts in their exact area, so are more likely to refer to electronic journals and experts in other hospitals / countries. The advantage of electronic journals is that these can be accessed from any computer, not just the location of the paper-based journal. Another potential issue is that GPs have many electronic journals, compared to the lower number (often just one core journal) in the specialist acute sector disciplines. Therefore for a GP, looking up an answer in a journal is not necessarily straightforward.

The GPs ranked "colleagues" as their first choice (second choice for acute-sector doctors). GPs workloads are varied, but similar issues occur across practices. This combined with the recent culture in the UK to promote and disseminate "best practice", has encouraged GPs to look at the practices of others. Therefore, ranking colleagues first is not that surprising given this environment.

Respondents were asked how they currently accessed electronic information at work and how they would like to access this information.. The network computer responses were similar, but the other technologies produced different responses. The responses from the acute sector show a much higher use of wireless laptops and mobile phone SMS. In fact the "would like to use" percentage from GPs is similar to the current actual "use" by acute-sector doctors in these two areas. This shows that acute-sectors doctors are currently more likely to use these emerging technologies (and even more would like to use them), whilst some GPs expressed a willingness to use them.

5.2.1.3 Responses Compared by Years Graduated from Medical School

The marked change is in the use of paper resources (textbooks and journals) and EBM resources. Those who graduated over eleven years ago ranked the EBM resources listed in this research in fourth place, whilst those who graduated in the last ten years ranked this second. Doctors who graduated over twenty-one years ago ranked textbooks and journals (in paper format) first, whilst they were ranked fourth by those most recently graduated. This suggests that doctors who have recently been through medical school have been taught the benefits of EBM and the knowledge of which resources to access. At the same time the issues with paper-resources, particularly their currency, has made an impact on these doctors, hence their low ranking.

Colleagues were still ranked favourably, first with those recently graduated and second by others. Newly qualified doctors are still developing their skills and knowledge so asking colleagues for advice is understandable, especially since these are likely to be more senior (registrars and consultants) and thus knowledgeable. Those who graduated over twenty-one years ago would have asked colleagues in their early years as electronic and "EBM" resources were not available. This potentially explains their high ranking of colleagues.

Respondents were asked how they currently accessed electronic information at work and how they would like to access this information.. The "newer" technologies, wireless laptop, PDA and mobile phone SMS were all used the most by those that graduated between 11 and twenty years ago, closely followed by those that graduated in the last ten years.

5.2.1.4 Comparison of UK Doctors Results to Other Research

Table 5.6: Rankings of Information Sources Utilised

Study	Country	Text Sources	Human	Electronic Resources
Arroll et al., 2002	New Zealand	1st	2nd	3rd
Cullen, 2002	New Zealand	1st	2nd	
Oliveri, Gluud & Willie-Jørgensen, 2004	Denmark	1st	2nd	3rd
Kim, Bartlett & Lehmann, 2005	USA	2nd	1st	3rd
McCord et al., 2007	USA	3rd	2nd	1st
Karen Davies, 2008	**UK**	**2nd**	**1st**	**3rd**

Table 5.6 shows this study has results similar to Kim, Bartlett & Lehmann (2005), "human" first and "text sources" second. Most of the other studies ranked text sources first and "human" second. This research, as with all but one of the previous studies, ranked electronic resources third. Results from this research usually correlate with non-USA research, so the UK responses to this question were not anticipated. One issue that may explain the results is the combining of the responses to "fit" the headings utilised in this research. When comparing results from studies that did not rank the resources, but used actual percentages, the difference between the textbooks (34.4%) and humans (31.1%) was negligible (Ely et al., 2005; Schilling et al., 2005; D'Alessandro, Kreiter & Peterson, 2004; Ramos, Linscheid & Schafer, 2003; Cogdill et al., 2000; Fozi et al., 2000; Green, Ciampi et Ellis, 2000; Ely et al., 1999; McAlister et al., 1999; Barrie & Ward,

1997; Gorman & Helfand, 1995; Lundeen, Tenopir & Wermager, 1994; Ely, Burch & Vinson, 1992; Covell, Uman & Manning, 1985). This suggests that the difference between the first and second ranking is not that significant.

The findings by McCord et al. (2007) have not been replicated in this research, suggesting that this was not the start of a trend of increased used of electronic resources.

5.2.1.5 Comparison of Acute-Sector Doctors' Results to Other Acute-Sector Research

The data from this research were combined to fit the categories from previous studies. "Humans" responses combined "colleagues" and "other health professionals", whilst "computer search" combined "full text electronic journals" and "EBM resources listed above".

Table 5.7: Information Sources Utilised by Acute-Sector Doctors

Study	Country	Printed Text Resources	Humans	Computer Search
Green, Ciampi et Ellis, 2000	USA	66%	25%	
Ramos, Linscheid & Schafer, 2003, Resident	USA	49.7%	48.5%	
D'Alessandro, Krieter & Peterson, 2004 - Control	USA	50.6%	27%	14.5%
D'Alessandro, Krieter & Peterson, 2004 - Intervention	USA	36.8%	30.3%	21.1%
Schilling et al., 2005	USA	41%	1.5%	55.3%
Karen Davies, 2008	**UK**	**23.1%**	**26.5%**	**50.6%**

Table 5.7 shows the importance of "human" as a resource remains fairly consistent, except for the research by Schilling et al. (2005). This shows that human contact is still favoured by doctors. However, the use of "printed text resources" has declined in this research to be replaced with "computer search". This is similar to the latest research by Schilling et al. (2005) and shows an increase to the research before that by D'Alessandro, Krieter & Peterson (2004). This suggests that computerised resources are being increasingly used by acute-sector based doctors.

5.2.1.6 Comparison of GPs' Results to Other GP Research

The data from this research were combined to fit the categories from previous studies. "Humans" responses combined "colleagues" and "other health professionals", whilst "computer search" combined "full text electronic journals" and "EBM resources listed above".

Studies were only included from 1996 onwards when EBM resources and the computerisation of these, whilst in its infancy, was becoming more widely available to medical staff.

Table 5.8: Information Sources Utilised by GPs

Study	Country	Printed Text Resources	Humans	Computer Search
Barrie & Ward, 1997 (Reported)	Australia	59%	40%	1%
Ely et al., 1999	USA	36%	36%	2%
Cogdill et al., 2000	USA	69%	27%	
Fozi et al., 2000	Malaysia	45.1%	16.1%	22.5%
Ely et al., 2005	USA	45%	18%	16%[16]
Karen Davies, 2008	**UK**	**22.4%**	**50.6%**	**27%**

[16] 12% computer and 4% handheld computer

Table 5.8 illustrates the results from studies on the information sources used by primary care doctors. Research in the USA generally shows a lower reliance on "humans" as an information source. The "printed text resources" are being replaced by "computer search" in the later research, as was the case with the acute-sector doctors.

5.2.2 Doctors awareness and use of electronic EBM resources

The National Library for Health (NLH) provides links for doctors and other health professionals to the following EBM resources (http://www.library.nhs.uk/Default.aspx):

- Cochrane Library Database of Systematic Reviews;
- The Database of Abstracts of Reviews of Effects (DARE);
- Health Technology Assessment Database (HTA);
- Medline / PubMed.

The questionnaire respondents were also asked to respond on their awareness and use of a further ten resources (Bandolier; BestBets; Clinical Evidence; Drug & Therapeutics Bulletin; DynaMed; Evidence Based On Call; InfoRetriever; MDConsult; TRIP; and UpToDate).

5.2.2.1 Total Responses

The most frequently used was Medline / PubMed followed by the Cochrane Database of Systematic Reviews, followed by Clinical Evidence. A study by Curtis, Weller & Hurd (1993) found that those resources that had been available for the longest period of time were used the most frequently. This research confirms this finding as the two resources most frequently used were the two most established and well-known resources.

DARE (Database of Abstracts of Reviews of Effects) was the resource most respondents had never heard of, followed by the Health Technology Assessments (HTAs). DARE assesses those reviews not undertaken by the Cochrane Database of Systematic Reviews. HTAs provide information on the cost and effectiveness of health technologies, such as new equipment, pharmaceuticals, medical procedures and healthcare settings. These are both supplementary resources that complement mainstream resources such as the Cochrane Database of Systematic Reviews and Clinical Evidence, so are likely to be known by those most interested in locating evidence and thus willing to look beyond one or two key resources.

One respondent e-mailed that "There are several [resources] that I have tried and thought pretty useless so stopped (e.g. DARE). But there wasn't an option for this in your questions - it sort of assumed if I used it at all I kept using it!" This is an accepted limitation with the design of that question on the questionnaire. This question would have been useful to answer, but really needed to be addressed in an interview to determine why a particular resource was not worth continuing to use.

One respondent e-mailed of their surprise at "no mention of national library for health as a resource" [Dr MC]. However in this research resources on NHSnet and the National Library for Health were included, though their host site was not specified. It is interesting to note that this respondent felt it worth commenting that the National Library for Health was not included, as this is really an information portal pointing to resources, rather than a resource itself.

Three resources used by over fifty per cent of respondents were the Drug & Therapeutics Bulletin and Clinical Evidence, followed by Bandolier. These resources are general non-specialist specific resources. The popularity of these resources may be due to the fact that originally all of these were paper-based resources. The perception that print resources are more useful in the clinical setting reflects the findings of a study in a Singapore hospital (Phua & Lim, 2007). One doctor e-mailed that they still preferred to use the paper-version of BNF and Clinical Evidence as switching between the screens during a consultation "took longer" than looking up the information in the paper text versions [Dr SM]. These resources were not suitably integrated into the clinical system the doctor was utilising for patient management.

The least used general resource was TRIP, with over-three quarters of the respondents "not having heard" of the resource. This resource has only ever been an electronic resource, so that suggests there are problems marketing such resources to doctors. This is particularly relevant to the NHS and its new electronic resources, such as the NHS-funded Clinical Knowledge Summaries launched in 2006 (http://cks.library.nhs.uk/) and DynaMed, to which access was granted to UK doctors by EBSCO Publishing in 2007 (http://www.ebsco.com/home/whatsnew/jan07-nhs.asp).

Over four-fifths of respondents had not heard of BestBets or Evidence Based On Call. However, both of these are specialist resources focussing on emergency medicine

Over three-quarters of the respondents had not heard of the American resources (DynaMed, InforRetriever, MDConsult and UpToDate). This highlights that if these resources are to be introduced successfully in the UK, they need to be heavily marketed to promote their benefits to the doctors' clinical practice.

Three doctors took the time and effort to e-mail that they used Google and / or Google Scholar. Dr WH stated that "Google and Google scholar are much better than the dedicated medical search engines for most information - also can be used during a consultation." Dr ND e-mailed "Google + medical journals to look at the original papers" was his information seeking approach. This illustrates the "marketing power" of this well-known Internet search engine. The website is quick to access (as it does not required the user to login), easy to search and produces fast results. The ease and speed of Google must be a major advantage to practising doctors. However, the information downloaded must be validated or reviewed before doctors use it for patient consultations. The popularity of this search engine suggests that medical doctors should be taught how to evaluate and validate websites to ensure that their medical practice is sound if they use the general Internet for health information.

5.2.2.2 Comparing Acute-Sector Doctor to GP Responses

Acute-sector doctors used all these resources more than GPs, in the case of Health Technology Assessments (HTAs), this was by twice as many respondents. Conversely GPs were less likely to be aware of these resources. For example 15% of GPs were either not aware of or had not used Medline / PubMed compared to 1.5% of acute-sector doctors. The higher use of resources by acute-sector doctors may be due to several reasons:

- Hospitals generally have their own libraries and professional information staff to raise awareness of electronic resources, especially those that are less well-known such as the Health Technology Assessments.
- The nature of the work itself. GPs handle a much wider range of medical issues, but most are minor ailments and there is a high degree of repetition. Acute-doctors treat more unusual unique cases, so are more likely to need to search for new evidence.

Twice as many GPs use Bandolier compared to acute-sector doctors, whilst more GPs use Clinical Evidence and the Drug and Therapeutics Bulletin than acute-sector doctors. All these resources are general resources which are ideal for the non-specialist nature of general practice.

Four times the number of acute-sector doctors use BestBets than GPs. BestBets is a database primarily aimed at emergency care doctors, who are based in the UK in the acute-sector.

Three times the number of acute-sector doctors use MDConsult and UpToDate than GPs. Both these resources provide access to specialist information, such as cardiovascular medicine, infectious disease and oncology, which are primarily treated by acute-sector doctors. MDConsult also has a diagnosis element, which again occurs more frequently in the acute-sector.

5.2.2.3 Responses Compared by Years Graduated from Medical School

The percentage of doctors who had not heard of Health Technology Assessments (HTAs) decreased the longer the respondent had graduated from medical school. HTAs provide information on the costs, effectiveness and broader impact of health technologies. These are aspects that senior, more experienced (and thus graduated from medical school earlier) doctors will be concerned with as overall managers (or consultants) of patients and their treatment, rather than more recently graduated doctors, since these doctors are more likely to make the final selections on the purchasing of new equipment and other technologies.

The percentage of doctors who had not heard of Bandolier and the Drug and Therapeutics Bulletin decreased the longer the respondent had graduated from medical school. Bandolier and the Drug and Therapeutics Bulletin were originally launched as paper resources, so doctors who graduated earlier may well have become used to the resource in that format and then been aware of the move to the electronic version as the paper edition discontinued.

The percentage of doctors who had not heard of TRIP decreased the longer the respondent had graduated from medical school. This suggests that TRIP has been heavily promoted in journals, at continuing medical education events and conferences, but not in the undergraduate education at medical schools.

The percentage of doctors who did not use Medline / PubMed occasionally or regularly increased the longer the respondent had graduated from medical school. This result may be due to two reasons. The first being that doctors who graduated more than fifteen years ago would have been unlikely to have used computers in general for locating evidence, or Medline / PubMed in particular. Secondly, doctors who graduated earlier will have more knowledge gained from practical experience, so do not feel the need to access Medline / PubMed for information or prefer to utilise another source of information, likely to be a colleague.

The percentage of doctors who had not heard of UpToDate increased the longer the respondent had graduated from medical school. UpToDate is an American resource, so doctors who have not been in education recently may not be aware of this resource. There is also a subscription attached to the resource (as it is not provided free by the NHS), so unless a doctor has prior experience of it or been recommended to use it, they are unlikely to personally pay to access it. Many doctors use conferences to keep-up-to-date, as e-mailed by one respondent "Q12 missed off conferences as best source of EBM" [Dr DL]. Two earlier studies mentioned the importance of professional meetings as a useful information source, which are similar to conferences (Shelstad, 1996; Dee & Blazek, 1993).

5.2.2.4 Comparison of UK Doctors' Results to Other Research

Sigouin & Jadad (2002) compared perceived use of resources between generalists (family doctors) and specialists, in this case, oncologists. These results were compared with this study as illustrated in Table 5.9. In both studies the acute-sector doctors used the resources more.

Table 5.9: Comparison of Use of Research Evidence in Study by Sigouin & Jadad, 2002 and This Research

Resources Utilised	Acute-Sector	GPs
Used the Cochrane Database of Systematic Reviews	79.3%	63.9%
Used the Cochrane Collaboration (Sigouin & Jadad, 2002)	75%	33%
Used Medline / PubMed	96.4%	75.1%
Used Medline (Sigouin & Jadad, 2002)	100%	92%

5.2.2.5 Comparison of Acute-Sector Doctors Results to Other Acute-Sector Research

A UK survey by Lewis, Urquhart & Rolinson (1998) found that the most used electronic database was Medline. This research found the same result, with the Cochrane Database of Systematic Reviews second. The popularity of Medline could well reflect the length of time the resource has been available. Index Medicus developed at the start of the 20th century, with an electronic version, MELDARS launched in 1964 (Pritchard & Weightman, 2005). Since then CD-ROM and web-based versions have improved access for medical professionals. This long history may explain the popularity of the resource, since the fact that it contains original research articles and not synthesised information (like the Cochrane Database of Systematic Reviews), means that Medline is not the ideal source for answering patient-care questions.

In a survey by Ramos, Linscheid & Schafer (2003), EBM resources such as original research and the Cochrane Library were rarely used by the residents. This was not the case in this research, as over three-quarters of the acute-sector doctors had used the Cochrane Database of Systematic Reviews. The Ramos, Linscheid & Schafer (2003) study only considered one University faculty programme, whilst this research collected data from many sites. The use of different sample populations may have impacted on the results.

A study by Scott, Heyworth & Fairweather (2000) of Australian and New Zealand internal medicine doctors found the evidence source used most frequently was Medline (76%), with Cochrane Library used by 11%. In this research Medline / PubMed was used by 96.4% and the Cochrane Database of Systematic Reviews by 79.3%. The data for this study were collected seven years after the Scott, Heyworth & Fairweather (2000), which is a period of time that has seen an increased use and acceptance of IT in the workplace such as the NHS (Smith et al., 2003).

A survey of radiation oncologist registrars in 2003 found 50% were aware of DARE and 15% had used it, and over 90% were aware of the Cochrane Library and 49% had used it (Wong & Veness, 2005). In this research, less than one percent of the acute-doctors had not heard of the Cochrane Database of Systematic Reviews and 79.3% had used it, which are higher figures than the Wong & Veness (2005) study. However, fewer than 40% were aware of DARE which is a lower figure than the Wong & Veness study (2005). This suggests that whilst UK acute-doctors have embraced the Cochrane Database of Systematic Reviews more than the registrars in the Wong & Veness (2005) study, the UK doctors have been less adventurous in learning about further Cochrane Library resources, such as DARE.

In the Schilling et al. (2005) study, the electronic sources utilised were Medline (73%) and Cochrane Library (3%). This research showed higher use of these two resources, 96.4% used Medline and 79.3% the Cochrane Database of Systematic Reviews. The largest difference was in the use of the Cochrane Library. This may be due to the fact that the Schilling et al. (2005) study considered one specialism in the acute sector, internal medicine, whilst this study considered all doctors working in the acute sector.

An American study by Perley et al. (2007) found acute-sector doctors used Medline / PubMed (81.1%) and the Cochrane Database of Systematic Reviews (25.3%). In this research Medline was used by 96.4% and the Cochrane Database of Systematic Reviews by 79.3%. The most significant difference is with the use of the Cochrane Database of Systematic Reviews. The Cochrane Library resources are freely available in the UK, which possibly explains their higher use.

Another 2007 study, by Poolman et al. surveyed members of the Dutch Orthopaedic Association and found 16.3% were unaware of the Cochrane Database of Systematic Reviews. In this research, less than one percent of acute-sector doctors were not aware of this database. This research was not limited to one medical specialism, but to the acute-sector as a whole. This makes direct comparison of the results problematic.

Perley et al. (2007) found 54.8% of acute-sector doctors used UpToDate compared to 5% in this research. UpToDate is a US resource that is not freely available to NHS staff which explains its low use in the UK.

5.2.2.6 Comparison of GPs' Results to Other GP Research

A study of general practitioners in the UK found 69% had not heard of the Cochrane Database of Systematic Reviews (Prescott et al., 1997). In this research less than 5% were unaware of this resource. During the Prescott et al. (1997) research the Cochrane Library was not available on CD-ROM or via the Internet, which may explain the significant difference between the studies. The Cochrane Database of Systematic Reviews is now available freely on the Internet, so access is not an issue.

McColl et al. (1998) studied GPs in England in 1997 and found the results shown in Table 5.10. The results from this research have been amalgamated ("used" includes "regularly use" and "occasionally use") or removed ("aware of, but would like more training before using") for comparison. There has been a significant increase in the awareness and use of the Cochrane Database of Systematic Reviews, but only a small increase in the use of the Database of Abstracts of Reviews of Effectiveness (DARE).

Table 5.10: Comparison of McColl et al., 1998 Results with GP Results in This Research

	Unaware	Aware but not used	Used
Cochrane Database of Systematic Reviews	4.5%	18.5%	77%
McColl et al., 1998	59.5%	31.3%	5.3%
Database of Abstracts of Reviews of Effectiveness	76.7%	15.1%	8.2%
McColl et al., 1998	81.6%	15.2%	2.5%

A London study found a third of GPs had used the Cochrane Library and over half had never heard of it (Ram & Wellington, 2002). Awareness of one database in the Cochrane Library was higher in this research, with more than 95% aware of the Database of Systematic Reviews.

A later survey of UK general practice staff found that 11% were still unaware of Cochrane (Wilson, Glanville & Watt, 2003). That is double the response from this research. This shows that awareness of the Cochrane Library is still increasing, though as shown earlier, primarily the one database, the Cochrane Database of Systematic Reviews.

Research by Young & Ward (1999) considered Australian GPs access, awareness and use of the Cochrane Library. The results are not comparable to this research as 70% of the respondents stated that they had no access to the Cochrane Library.

The Cullen (2002) study of family doctors in New Zealand found doctors accessed Medline (70%) and Cochrane (38%). In this research GPs used Medline a similar amount (75%) and the Cochrane Database of Systematic Reviews was used by more doctors (63.9%).

McColl et al. (1998) investigated GPs in the Wessex region of England in 1997. Nearly half the respondents were unaware of Bandolier and fewer than a fifth had actually referred to it. In another UK study by Prescott et al. (1997) 86% of respondents had not heard of Bandolier. In this research just over 5% of GPs were not aware of Bandolier and over half had used it. This shows a considerable rise in awareness and use of this resource. Bandolier was launched in 1994, so these two studies illustrate how long it can take for a resource to be promoted effectively so that doctors are aware of it, let alone actually use it.

In the Prescott et al. (1997) study, 94% of respondents used the Drugs and Therapeutics Bulletin. In this research that figure had fallen to 77%. This is likely to be because the central-funding for this publication was removed in 2006 and since then GPs who wish to access this resource must purchase their own personal subscription (Brettingham, 2006). The Drugs and Therapeutics Bulletin is a well-established resource, started in 1962 (http://dtb.bmj.com/info/about.dtl) so illustrates that resources that have been around for a long time are more likely to be used, especially if they meet an information need. The fact that usage has fallen since free access for NHS staff has been removed highlights the importance of providing free access to suitable and relevant resources for doctors.

5.2.3 Ranking the perceived barriers to using electronic information resources as an aid in clinical decision making

5.2.3.1 Total Responses

The respondents were given five options to rank in order, from the most important to the least. No "free text" responses were permitted. Therefore any perceived barrier an individual thought was important, that was not listed, would not be included.

The most significant barrier was the "time" required to search for information. This will always be an issue with the time constraints doctors are under, particularly in the NHS.

Poor access to electronic resources was the least significant barrier. This suggests that the investment in IT over the past ten years has positively impacted on doctors' ability to access and search electronic resources.

5.2.3.2 Comparing Acute-Sector Doctor to GP Responses

The results were broadly similar except for the third and fifth rankings of perceived barriers. The GPs ranked "lack of knowledge of resources" third and "lack of easy access to electronic resources" fifth, whilst the acute-sector doctors ranked these the other way round. GPs have access to computers on their desks during the patient consultation whilst the acute-sector doctor standing beside a patient's bed will not have ready access to a networked PC or laptop (and PDA use is low). This may explain the difference in "access" ranking. GPs lacked search skills when using Medline / PubMed so a "lack of knowledge or resources" ranking third reflects their lack of knowledge generally and highlights training issues that need addressing.

5.2.3.3 Responses Compared by Years Graduated from Medical School

The "lack of knowledge of resources" was ranked fifth by those recently graduated, compared to third by those who left medical school more than twenty-one years ago. This reflects the dynamic nature of these resources, especially the number of resources that have developed over the past ten years that those who graduated prior to this would not have encountered whilst studying.

Those most recently graduated ranked a "lack of searching skills" third, whilst those who graduated over twenty-one years ago ranked this last. Recent graduates may rank this more highly even if they actually possess superior search skills to those who graduated earlier. This may be because doctors who graduate more recently are more aware of the advanced search features available in the online databases.

5.2.3.4 Comparison of UK Doctors' Results to Other Research

Previous research has also identified "time" as the main barrier to using electronic information resources as an aid in clinical decision making (Andrews et al., 2005; Green, Ciampi & Ellis, 2000; Scott, Heyworth & Fairweather, 2000; Lewis, Urquhart & Rolinson, 1998; McColl et al., 1998).

Bennett et al. (2004) considered barriers to doctors' use of the Internet. Lack of time was not identified as a factor, but the three key points (in order) were searching difficulties, too much information and specific information required not available. In this research, the second highest barrier after time was the information not being relevant (to the clinical situation), which was ranked third in Bennett et al.'s (2004) work. This suggests the UK doctors are more confident with their search skills, but feel that information available is not relevant for immediate patient care.

5.2.3.5 Comparison of Acute-Sector Doctors' Results to Other Acute-Sector Research

Table 5.11: Barriers to Literature Searching for Acute-Sector Doctors

Study	Lack of time	Irrelevant material	Issues with IT or online resources	Limited search skills
Lewis, Urquhart & Rolinson, 1998	60.6%			32.2%
Green, Ciampi & Ellis, 2000	60%		2%	
Scott, Heyworth & Fairweather, 2000	35.5%	23.8%	20.8%	19.9%
Karen Davies, 2008	**44%**	**29.1%**	**20.5%**	**6.5%**

Table 5.11 compares the barriers identified by acute-sector doctors to literature searching. Direct comparison is possible with the results from the research by Scott, Heyworth & Fairweather (2000). The major difference is the response to "limited search skills". This suggests that in the UK acute-sector this is now much less of an issue, compared to those doctors who participated in the research in Australia in 1998-1999 and the UK research undertaken in 1996 (Lewis, Urquhart & Rolinson, 1998). Nearly one third of UK doctors felt irrelevant material was an issue which actually may be the result of inadequate search techniques that the doctors themselves are not aware of (hence the low ranking for "lack of searching skills").

5.2.3.6 Comparison of GPs' Results to Other GP Research

Table 5.12: Barriers to Literature Searching for GPs

Study	Lack of time	Irrelevant material	Issues with IT or online resources	Limited search skills
McColl et al., 1998	70.7%	3.7%	5.8%	
Andrews et al., 2005	76%		22%	25%
Ely et al., 2005	19%	26%	8%	
Karen Davies, 2008	**55.1%**	**20.9%**	**17.9%**	**6%**

Table 5.12 compares the barriers identified by GPs to literature searching. This research, Andrews et al. (2005) and McColl et al. (1998) highlight "time" as the key barrier. The research by Ely et al. (2005) places "irrelevant material" first, which is also an important barrier in this research, placed second.

In a study of GPs' use of NHSnet, those who rarely used the site mentioned a lack of time and inability (that is, lack of skills) as key barriers (Wilson, Glanville & Watt, 2003). Time is still the key barrier; however the next issue is now irrelevant material. This suggests GPs are conducting searches and have more confidence in their search skills, but the retrieval of irrelevant material means that their search strategies may not be the most effective.

5.3 Evidence Based Medicine

5.3.1 Attitudes of Doctors to Evidence Based Medicine

5.3.1.1 Total Responses

Respondents were generally positive towards the practice of EBM, since nearly three-quarters (72.3%) of respondents selected "agree" or "strongly agree" for the statement; "EBM improves patients outcomes".

Respondents also seemed to be aware of the skills required to undertake EBM as step three is to critically appraise the evidence and 85.9% of respondents agreed or strongly agreed that "EBM required critical appraisal skills to assess the quality of research".

Over 60% of doctors felt that "busy doctors do not have time to find and critically appraise the relevant research papers". This suggests that doctors would be more inclined to access pre-appraised evidence that is more applicable in the patient care setting.

The "not sure" response can be construed as a "sit on the fence" response. Nearly one third (31.6%) of respondents were "not sure" whether "EBM is a good concept that fails in practice", whilst nearly a quarter (24.7%) were "not sure" if "practising EBM improves patient outcomes". These are significant numbers that have not been persuaded for or against the arguments to practice EBM.

5.3.1.2 Comparing Acute-Sector Doctor to GP Responses

GPs were more likely to "agree" or "strongly agree" that "busy doctors do not have the time to find and critically appraise the relevant research papers" (77.4% response compared to 54.5% from acute-sector doctors). This response probably reflects the different workloads between the two environments. GPs are more likely to be involved with the running and management of their practices, compared to UK hospital doctors, who can rely on the support structure of the hospital for more general administrative duties.

Acute-sector doctors were more likely to "agree" or "strongly agree" that "in most areas of medicine, there is little or no evidence to guide practice" (37.2% compared to 21.8% from GPs). This reflects the issue that systematic reviews from resources such as the Cochrane Library cannot effectively address all medical specialisms as the number of topics to cover is vast. These reviews are more likely to cover more generalised conditions and treatments as these have the largest potential audience.

Acute-sector doctors were more likely to "agree" or "strongly agree" that "EBM requires critical appraisal skills to assess the quality of the research" (91.6% compared to 77.8% from GPs). This may be due to the promotion in the primary sector of pre-synthesised information ready for use in patient care situations such as NICE guidance (http://guidance.nice.org.uk/) rather than locating the research data which require critical appraisal, and evaluation, prior to use in patient care.

5.3.1.3 Responses Compared by Years Graduated from Medical School

Respondents who had graduated from medical school recently were more positive about the practice of EBM and its effects on patient outcomes (82.4% "agree" or "strongly agree") compared to the average response (72.3%). Those who graduated since 1995 should have been taught, if not at least introduced to, EBM during their training. This background may lead to their more favourable response to the effectiveness of EBM on patient outcomes.

5.3.1.4 Comparison of UK Doctors' Results to Other Research

Researchers collected data from general internists in Canada in 1997 (McAlister et al., 1999). To enable comparisons with this research (Table 5.13), the responses in this study were converted from "strongly agree" / "agree" to "yes" and "strongly disagree" / "disagree" to "no". The "not sure" responses were excluded.

Table 5.13: Comparison of UK Doctors' Results to McAlister et al., 1999

	UK Doctors' Results		McAlister et al., 1999 – EBM Users	
	Yes	No	Yes	No
Improves patient outcomes	96.1%	3.9%	61.7%	38.3%
Little or no evidence to guide practice	36.3%	63.7%	25.7%	74.3%

Both statements produce more favourable results in this research, particularly the statement "practising EBM improves patient outcomes". The data collected for the McAlister et al. (1999) research were actually gathered in 1997. This is only five years after the phrase "Evidence Based Medicine" was first mentioned (Evidence Based Medicine Working Group, 1992). The data for this research were collected in 2006/07, ten years after the development of the EBM concept which has enabled doctors to develop a deeper awareness and understanding of the benefits of EBM to patient care. The recent development of synthesised resources to assist doctors in practicing EBM, such as InfoRetriever (1996), TRIP (1997) and Clinical evidence (1999), could account for the more favourable response to the lack of evidence to guide practice.

5.3.1.5 Comparison of Acute-Sector Doctors Results to Other Acute-Sector Research

Sur et al. (2006) surveyed American urologists in 2005. A ranking scale with 1 for strongly disagree to 10 strongly disagree (with a N/A option) was utilised. The respondents ranked the statement "surgical outcomes are improved by applying Evidence Based Medicine" "eight". This equates roughly to the option "agree" in this research, which did receive the most responses (57.3%). This suggests that the respondents shared similar views towards the impact EBM has on patient outcomes.

Veness, Rikard-Bell & Ward (2003) undertook research of acute doctors in Australia and New Zealand. There were distinct differences in responses to three statements when comparing responses, as illustrated in Table 5.14.

Table 5.14: Percentage Responses to Views and Attitudes Towards EBM – Acute Doctors Compared to Veness, Rikard-Bell & Ward, 2003

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Improves patient outcomes	0.6%	2.5%	23.8%	57.3%	15.8%
Improves patient care Veness, Rikard-Bell & Ward, 2003	0.5%	1.6%	6.8%	62.3%	28.8%
A good concept that fails in practice	3.4%	33.7%	31%	26.6%	5.3%
Veness, Rikard-Bell & Ward, 2003	6.3%	58.6%	19.9%	11.5%	3.1%
Little or no evidence to guide practice	6.2%	42.1%	14.5%	31.6%	5.6%
Veness, Rikard-Bell & Ward, 2003	55%	38.2%	3.7%	2%	0.5%
Medical information "explosion" overwhelming	3.7%	28.5%	13.9%	43.3%	10.5%
Veness, Rikard-Bell & Ward, 2003	3.1%	35.1%	11.5%	36.1%	13.6%

Nearly half the number of respondents in this research (15.8%) "strongly agree" that "EBM improves patient outcomes" compared to the "improves patient care" of Veness, Rikard-Bell & Ward, 2003 (28.8%). More respondents in this research opted for the "not sure" response. This suggests that nearly a quarter (23.8%) of UK doctors are not sure of the benefits of EBM in practice.

Respondents to the Veness, Rikard-Bell & Ward, 2003 survey were more likely to "disagree" (58.6%) that "EBM is a good concept that fails in practice" compared to respondents in this research (33.7%). This reflects a more positive attitude of the Australian and New Zealand radiation oncologists and registrars to EBM in practice compared to UK doctors.

Veness, Rikard-Bell & Ward found respondents were more likely to "strongly disagree" and "disagree" (93.2%) that there is "little or no evidence to guide practice" compared to this research (48.3%). Veness, Rikard-Bell & Ward specifically researched radiation oncologists and registrars. When considering the oncologists in isolation, the numbers in this research are small (9), but 80% either "strongly disagree" or "disagree" with this statement. This highlights potential differences between individual specialisms and the "average" result for the acute-sector as a whole.

5.3.1.6 Comparison of GPs' Results to Other GP Research

Research by Callen, Fennell & McIntosh (2006) studied Australian GPs in 2003. Sixty-six percent of respondents either agreed or strongly agreed that practising EBM improved patient care. There is a difference in wording when comparing this result to the "patient outcomes" statement used in this research. Therefore a direct like-for-like comparison is not feasible. This is validated by Sur et al. (2006) who found that "outcomes are improved" was ranked "eight" (out of ten) whilst "improves patient care" was ranked higher at "nine". However in this research 69.7% agree or strongly agree with the statement "EBM improves patient outcomes". This suggests that doctors perceive the impact EBM has on patients to be growing positively.

O'Donnell (2004) asked general practice leads (all but one were doctors) their attitudes towards EBM. Table 5.15 illustrates the compared results between that study and this research. The results again possible reflect the different phrases used in the research, patient "outcomes" compared to patient "care". Also the numbers involved in both studies are different. This research received responses from 250 GPs, of differing levels of experience compared to the 45 leads / chairs (so likely to be experienced) involved in O'Donnell's study. This again impacts on direct comparison between the results as the sample populations are different.

Table 5.15: Comparison of UK Doctors' Results to O'Donnell, 2004

	"Agree" or "Strongly Agree"	
	UK GP Results	O'Donnell, 2004 – leads/chairs
Improves patient outcomes / care	73.1%	84.4%

GP results were compared with research undertaken in 2002 by Tracy et al. (2003) on Canadian primary care doctors. This research utilised the word "positive" instead of "agree", "neutral" instead of "not sure" and "negative" instead of "disagree". Whilst the terms are different the sentiments expressed are similar and therefore basic comparisons are reasonable. Table 5.16 illustrates the comparable statements.

Table 5.16: Percentage Responses to Views and Attitudes Towards EBM – GPs Compared to Tracy et al., 2003

	Strongly Disagree / Very negative	Disagree / Negative	Not Sure / Neutral	Agree / Positive	Strongly Agree / Very Positive
Little or no evidence to guide practice	6.2%	42.1%	14.5%	31.6%	5.6%
Tracy et al., 2003	13.5%	56.5%	19.2%	10.3%	0.5%

The GPs in this research were more likely to agree that there is little or no evidence to guide practice (37.2% compared to 10.8%). However the GPs in Tracy et al.'s (2003) research were less likely to agree with this statement (70% compared to 48.3%). This suggests either UK GPs have a more negative perception about the evidence available or that they lack the necessary skills to adequately and effectively locate the evidence themselves (so are therefore under the impression that the evidence does not exist).

Researchers collected data from general practitioners in England in 1997 (McColl et al., 1998). To enable comparisons with this research, the responses in this study were converted from "strongly agree" / "agree" to "positive". The responses for "strongly disagree", "disagree" and "not sure" were excluded.

Results for both studies for the statement "practising EBM improves patient care / outcomes" were identical with 70% of respondents in agreement with this statement. There is a difference in wording in this comparison. McColl et al. (1998) considered patient "care" whilst this research asked about "patient outcomes". Therefore a direct like-for-like comparison is not feasible. The results do show that GPs were keen to embrace EBM from the outset since the McColl et al. (1998) data was collected in 1997, only five years after the introduction of the EBM concept. The fact that the figure is the same five years later (for a slightly differently worded statement) suggests that in practice EBM has worked to an extent, but agreement with this statement has not risen.

5.3.2 Doctors' Understanding of Specific Evidence Based Medicine Terms

5.3.2.1 Total Responses

The EBM terms selected were those commonly used in journal papers about EBM, namely, relative risk, absolute risk, systematic review, number need to treat, confidence interval and publication bias.

Over 90% of respondents were either able to explain the EBM terms or had some understanding of them (except publication bias). Even though this is a self-rating and not an actual test of skill level in practice, this is still a positive result.

The two terms doctors were most aware of were "number needed to treat" (94.4%) and "systematic review" (94.2%). These are key EBM terms in clinical practice. Jordens et al. (1998) found that systematic reviews were used more commonly by those doctors familiar with computers. Since this research was restricted to computer-users only, this may explain the high percentage of doctors aware of this term.

The least understood term was publication bias, but still 87.8% perceived they understood the term to some degree. This is probably the most "academic" term in the selection and therefore would not seem to be the most relevant for practising doctors.

MacLeod & Mant (2002, p.280) suggested that it is "not necessary to be able to define something to be able to understand it". This would suggest that "some understanding" is in fact adequate for using the term in practice. In fact MacLeod & Mant (2002) highlight the fact that knowing or understanding a definition is not the same as actually being able to use it.

5.3.2.2 Comparing Acute-Sector Doctor to GP Responses

Two EBM terms produced different results, confidence interval and publication bias, though both are positive. The acute-based doctors understood to some degree, confidence interval (94.5%) and publication bias (92.8%) compared to the GPs understanding of confidence interval (84%) and publication bias (81.2%). Of the six terms identified in this research, these two are probably the most "academic" and least directly relevant to patient care management. This could explain the approximate 10% difference in response from acute-sector doctors in the more academic hospital settings compared to GP practices. However, research by Upton & Upton (2005) found that GPs rated their skills (that is their self-perception) lower that acute-sector doctors. This may also explain the difference in responses in this research.

5.3.2.3 Responses Compared by Years Graduated from Medical School

Overall there was a slight decline in the understanding of EBM terms the longer the doctor graduated from medical school. However, even of those respondents who left medical school more than twenty-one years ago, over 90% felt they understood most of the EBM terms (except publication bias with 85.6%). This illustrates how seriously doctors and their professional bodies view Continuing Professional Development (CPD). For example, the Royal College of Physicians require fifty CPD credits per annum to remain on the professional register (http://www.rcplondon.ac.uk/professional/cpd/CPDforUKphysicians.pdf).

5.3.2.4 Comparison of UK Doctors Results to Other Research

In the past five years there have been several articles published on doctors' understanding of EBM terms. This research has been undertaken in Australia, Holland, New Zealand and the USA. There has also been research published on GPs in the UK; in Scotland (O'Donnell, 2004) and in England (McColl et al., 1998).

A self-rating survey by doctors in both the primary and secondary sector found that 44% used the term Number Needed to Treat (Cowling, Newman & Leigh, 1999). In this research over 90% of respondents felt able to understand the term and explain it to others. Whilst these are not the same responses, as Cowling, Newman & Leigh (1999) asked about "use" and this research about "understanding", the fact that so many doctors were confident in their understanding of the term NNT, suggests they are likely to use it. Caution must be expressed when comparing these data as the Cowling, Newman & Leigh (1999) research only utilised 18 doctors compared to the 625 that answered the relevant question in this research.

Most of the other research into doctors' understanding of EBM terms had response options that force respondents to either provide positive or negative answers. However, if respondents had never heard of this term, their only option was to leave the question unanswered. This research included the option "I am unaware of this term". To enable comparison with the previous research the responses to this additional response option were not included.

5.3.2.5 Comparison of Acute-Sector Doctors' Results to Other Acute-Sector Research

The acute-based doctors' data from this research were compared to results from other self-rating studies in Table 5.17:

- Poolman et al., 2007, who investigated Dutch orthopaedic surgeons in 2005;
- Sur et al. (2006), who studied American urologists in 2005;
- Oliveri, Gluud & Willie-Jørgensen (2004) investigated acute sector doctors in Denmark in 2000.
- Veness, Rikard-Bell & Ward (2003) who researched Australian and New Zealand radiation oncologists and registrars in 2000.

This research received 344 responses compared to 367 by Poolman et al. (2007), 714 by Sur et al. (2006), 225 by Oliveri, Gluud & Willie-Jørgensen (2004) and 191 by Veness, Rikard-Bell & Ward (2003).

Table 5.17: Comparison of Acute-Sector Doctors' Self-Perceived Understanding of EBM Terms

	It would not be helpful for me to understand	I don't understand, but I would like to	Some understanding	Yes, I understand and I could explain to others
Relative risk	0.3%	2.9%	33.6%	63.2%
Poolman et al., 2007	1.6%	10.5%	50.3%	37.6%
Oliveri, Gluud & Willie-Jørgensen, 2004	0.4%	14.2%	46.6%	38.8%
Veness, Rikard-Bell & Ward, 2003	0%	2.6%	31.6%	65.8%
Absolute risk	0.3%	3.5%	32%	64.2%
Poolman et al., 2007	1.4%	13.8%	47.2%	37.6%
Veness, Rikard-Bell & Ward, 2003	0%	2.1%	32.1%	65.8%
Systematic review	0.3%	2.3%	18.3%	79.1%
Poolman et al., 2007	1.1%	6.1%	30.1%	62.7%

Veness, Rikard-Bell & Ward, 2003	0%	6.4%	35.6%	58%
Number needed to treat	0.3%	4.1%	23.9%	71.7%
Poolman et al., 2007	1.4%	8.3%	33.3%	57%
Sur et al., 2006	0.7%	14.4%	38.1%	46.8%
Oliveri, Gluud & Willie-Jørgensen, 2004	0.9%	14.5%	39.8%	44.8%
Veness, Rikard-Bell & Ward, 2003	0.5%	5.9%	34.8%	58.8%
Confidence interval	0.3%	4.1%	24.7%	70.9%
Poolman et al., 2007	2.5%	11.6%	34.5%	51.4%
Sur et al., 2006	0.7%	16.7%	34.2%	48.4%
Veness, Rikard-Bell & Ward, 2003	0.5%	3.6%	32.7%	63.2%
Publication bias	0.3%	5.5%	21%	73.2%

Poolman et al., 2007	4.1%	15.2%	40.6%	40.1%
Sur et al., 2006	1.1%	20.4%	33.4%	45.1%
Oliveri, Gluud & Willie-Jørgensen, 2004	0.5%	10.4%	33.9%	55.2%
Veness, Rikard-Bell & Ward, 2003	0.5%	8%	25.5%	66%

Relative risk and absolute risk data from this research are similar to those from Veness, Rikard-Bell & Ward (2003). This may be because the health system investigated in Australia and New Zealand by Veness, Rikard-Bell & Ward's (2003) research, is more comparable to the UK NHS.

The four other EBM research terms, (systematic review, number need to treat, confidence interval and publication bias) all had more favourable responses from this research. For example, in all the research over 90% had at least "some understanding" of the term "systematic review". However of those who could understand and explain to others, the response in this research was 79.1% compared to 62.7% (Poolman et al., 2007) and 58% (Veness, Rikard-Bell & Ward, 2003). This may be due to the method of selecting respondents. This research used an online survey so limited responses to those who used computers. Doctors were contacted by locating their e-mail addresses from websites or from journal articles / letters. This may skew the responses positively compared to the other studies as respondents have already been "pre-selected" to some degree in this research in that all are computer users with active e-mail addresses. Poolman et al. (2007) and Veness, Rikard-Bell & Ward (2003) posted their questionnaires to doctors who were computer users and non-computer users.

Estellat et al. (2006) asked acute-sector doctors to define terms and undertake calculations which were then marked. This research was on understanding in relation to actual use rather than self-perception (as with this research). Therefore direct comparisons are not relevant. However, the results do show the doctors in this research had a higher perception of their understanding of the two EBM terms compared to the actual skill level demonstrated in the Estellat et al. (2006) study. This is illustrated in Table 5.18.

Table 5.18: Estellat et al. (2006) EBM Term Results and UK Acute-Based Doctors Results

	UK Acute Sector Yes	Estellat et al. (2006) Yes
Number needed to treat	94.3%	65.4%
Confidence interval	94.5%	48.5%

5.3.2.6 Comparison of GPs' Results to Other GP Research

The data from this research were directly compared (in Table 5.19) to results from:

- Australia in 2003 Callen, Fennell & McIntosh (2006);
- England in 1997 (McColl et al., 1998).

This research received 250 responses compared to 135 by Callen, Fennell & McIntosh (2006) and 302 by McColl et al., 1998.

Table 5.19: Comparison of Acute-Sector Doctors' Self-Perceived Understanding of EBM Terms

	It would not be helpful for me to understand	I don't understand, but would like to	Some understanding	Yes, I understand and I could explain to others
Relative risk	0.8%	4.5%	47.8%	46.9%
Callen, Fennell & McIntosh, 2006	3.7%	13.3%	60.8%	22.2%
McColl et al., 1998	2.4%	10.6%	54%	33%
Absolute risk	1.2%	5.3%	45.1%	48.4%
Callen, Fennell & McIntosh, 2006	3%	14.1%	58.5%	24.4%
McColl et al., 1998	2.4%	13.7%	52.6%	31.3%
Systematic review	0.4%	6.1%	40.2%	53.3%
Callen, Fennell & McIntosh, 2006	3.7%	28.2%	54.8%	13.3%
McColl et al., 1998	2.8%	19.1%	55.5%	22.6%
Number needed to treat	0.4%	2.1%	28.8%	68.7%

Callen, Fennell & McIntosh, 2006	4.4%	17.9%	44.4%	33.3%
McColl et al., 1998	2.1%	18.7%	43.8%	35.4%
Confidence interval	1.2%	12%	44.6%	42.2%
Callen, Fennell & McIntosh, 2006	8.1%	48.2%	32.6%	11.1%
McColl et al., 1998	5.9%	31%	42.8%	20.3%
Publication bias	1.7%	13%	40.3%	45%
Callen, Fennell & McIntosh, 2006	8.1%	43.7%	38.6%	9.6%
McColl et al., 1998	7.3%	30.8%	46.5%	15.4%

There has been a noticeable increase in understanding in all terms in the UK since the last research published in this area in 1998 (McColl et al.). This research adds to the literature, suggesting that GPs in the UK are continuing to develop their knowledge and understanding of EBM terms.

The responses to this research are considerably more positive towards understanding EBM terms compared to the research by Callen, Fennell & McIntosh, 2006. This may be due to the fact that the UK (with Sackett as a particular supporter) was an early adopter of EBM (Sackett et al., 2000; Sackett & Straus, 1998; Sackett et al., 1996; Sackett & Rosenberg, 1995; Sackett et al., 1991).

Table 5.20: Comparison Between O'Donnell (2004) Research and UK GP Results

	Some understanding or understand / could explain to others	
	UK GP	O'Donnell (2004)
Relative risk	92%	71.1%
Absolute risk	91.2%	66.7%
Systematic review	91.2%	66.7%
Number needed to treat	94.8%	77.8%
Confidence interval	84%	35.6%
Publication bias	81.2%	35.6%

Table 5.20 illustrates that the results from this research are more positive than the earlier study by O'Donnell (2004). The most improvement in understanding was for "confidence interval" and "publication bias". This suggests that the knowledge and understanding of EBM in general practice has grown in the last five years, particularly with the more technical, academic terms.

Considering the top response only (Table 5.21), this GP research data was compared to results from Young, Glasziou & Ward (2002). Young, Glasziou & Ward (2002) investigated fifty Australian GPs in Sydney, Australia. In the Australian research the doctors were also asked to define the terms which actually showed the terms were frequently misunderstood by doctors. This research only investigated doctors' self-perception rather than actual skill level. In this comparison the data from the Australian GPs perceived responses were used, not the data from the skills assessment.

Table 5.21: Comparison Between Young, Glasziou & Ward (2002)Research and UK GP Results

	Understand and could explain to others	
	UK GP	Young, Glasziou & Ward (2002)
Relative risk	46.9%	18%
Absolute risk	48.4%	30%
Number needed to treat	68.7%	16%

GP responses in this research were more favourable compared to Young, Glasziou & Ward (2002). This may be due to the different years in which the data were collected or, as previously stated, that the UK was an early adopter of EBM.

6 Conclusions and Recommendations

The conclusions and recommendations chapter considers the objectives of the research (and whether these were met). Recommendations are provided and contributions to the literature highlighted. Further potential research is also identified.

6.1 Objectives of Research

The objectives of the research were subdivided under the headings; Information Needs, Information-Seeking Behaviour and Evidence Based Medicine. The objectives of this research were all met, however the key findings are highlighted below.

6.1.1 Information Needs

6.1.1.1 To quantify the information needs of doctors.

The results suggest that the research context is important. Therefore direct comparisons between the USA and UK are not relevant when considering doctors' information needs as their environments are not comparable.

This untested research technique of utilising clinical librarians to collect the data enabled the identification and quantification of doctors' unperceived information needs.

6.1.1.2 To understand the types of information needs of doctors.

Doctors asked most questions on "treatment" issues, on average two treatment questions for every one on diagnosis.

Analysis of the results, using the taxonomy developed by Ely, found similar results for UK GPs and acute-sector based doctors. UK GPs did not ask similar questions to US primary care doctors (Ely et al., 2000).
Background questions are general non-patient specific questions, whilst foreground questions relate directly to a patient. For every ten questions posed by UK doctors, six related directly to a patient.

6.1.2 Information-Seeking Behaviour

6.1.2.1 To understand the preferences of doctors in locating evidence.

Overall the preferred information source was colleagues.

6.1.2.2 To determine doctors' awareness and use of electronic Evidence Based Medicine resources.

The most frequently used EBM resource available via the National Library for Health were the most established and well-known resources, namely, Medline / PubMed, followed by the Cochrane Database of Systematic Reviews. DARE (Database of Abstracts of Reviews of Effects) was the least well-known resource. The top three resources not freely available via the National Library for Health were general non-specialist specific resources: the Drug & Therapeutics Bulletin: Clinical Evidence; and Bandolier. These general resources were used more by GPs than acute-sector based doctors. Over three-quarters of the respondents had not heard of the American resources.

6.1.2.3 To rank the perceived barriers for doctors accessing electronic information as an aid in clinical decision making.

The most significant barrier was the "time" required to search for information, whilst poor access to electronic resources was the least significant.

6.1.3 Evidence Based Medicine

6.1.3.1 To identify the attitudes of doctors to Evidence Based Medicine.

Respondents were generally positive towards the practice of EBM. However, a significant minority were unconvinced as to the benefits of practising EBM.

6.1.3.2 To determine the understanding doctors have of specific Evidence Based Medicine terms.

Respondents seemed to be aware of the skills required to practice EBM. The majority of respondents were either able to explain (or had some understanding of) all but one of the EBM terms. There has been a noticeable increase in understanding of EBM terms by GPs in the UK since research published in 1998. These results are self-ratings by doctors so may potentially not reflect the real world situation they experience, but they reflect doctors perceptions that they have a good understanding of EBM.

6.2 Recommendations

This is the first research to quantify doctors' clinical information needs in the UK. A ratio of doctors to clinical information needs was produced which was then extrapolated for all registered doctors in the UK. This is also the first research in the UK to qualify the information needs of doctors by analysing clinical questions. These points highlighted the need to enable access to resources that may provide the information to answer these clinical questions.

There is a resource implication for the publishers of EBM sources. The temptation for publishers has been to convert as many resources as possible in the health arena to electronic format. Whilst this had benefits to the ease of updating and reduced publishing costs, it is worth noting that some resources are still preferred by users in paper format. The most notable resource used by participants in this research, particularly as this was not mentioned in the electronic resources as such, was the BNF (British National Formulary). Unless this is integrated seamlessly into the current doctor's/patient management programme then the conclusion is that a paper version is easier to refer to for the doctor (user) than switching between computer screens. This highlights that the introduction and development of EBM resources should be user-driven not IT-driven / focussed.

The NLH (National Library for Health) is an IT-intensive solution to enabling access to resources to provide the information to answer clinical questions. However, an important point to consider is whether IT is the solution. Doctors have confirmed in this research that their first choice of resource is to contact colleagues. Learning from peers is a natural and well-established process in medicine which is always likely to continue to some extent. Communicating with peers develops social networks and can stimulate doctors to work collaboratively jointly developing skills. These benefits are not an available option when using IT resources. The implication that can be drawn from this is that IT should be the last consideration not the driver for resource provision for doctors.

Over three-quarters of the respondents had not heard of the American resources. Therefore, if any of these resources are to be introduced successfully in the UK, they need to be heavily promoted to illustrate their benefits to doctors' clinical practice.

When introducing new information resources, such as the Map of Medicine (http://www.mapofmedicine.com/), the needs and concerns of all users must be addressed, not just those who are the most vocal or "powerful". Otherwise, in practice, the system will not be utilised to its full potential. New adopters of schemes such as Map of Medicine (http://www.mapofmedicine.com/) are important as they test the product in the clinical setting, but unless the resource itself is effectively disseminated, optimal use is unlikely to be attained.

Resources that are purely electronic need to be marketed and promoted effectively. This could be an issue with new resources only developed electronically, for example the Map of Medicine (http://www.mapofmedicine.com/) which is currently being developed in the NHS. This resource must be well-promoted with the benefits of using the resource highlighted.

The findings that nearly half the respondents only undertake simple searches or do not employ effective search strategies for complex searches identifies a potential training issue. This issue needs to be addressed by CPD for qualified doctors, but also suggests that the medical school curriculum needs to ensure that information-seeking skills are effectively taught, and then reinforced, in their programmes. This is particularly true in General Practice, where respondents were half as likely as acute-sector doctors to use any of the search features of Medline / PubMed.

Since time is such an issue, the solution maybe for doctors to only seek information to answer the basic simple time-efficient clinical questions. The experienced information searcher (such as a medical librarian, clinical librarian or a website addressing clinical questions) would then answer the more complex time-intensive clinical questions. This would then maximise the effective use of staff time with doctors not spending excessive amounts of time undertaking complex specialist searches (instead of spending more time on patient care) and information professionals utilising their specific skills. This would be an effective management of time and skills.

This research found that doctors were generally in favour of EBM and their understanding of specialist terms had improved since previous research in the UK (1998). However, given the time constraints, doctors' preference to consult with colleagues and the skill level of doctors to undertake specialist information searches, what is the future of EBM? This research suggests that whilst the awareness and appreciation of practising EBM was positively embraced in principle, in practice the lack of time and specialist skills prevented this being optimised. There can be no point teaching doctors specialist information searching skills, if time constraints mean they will never be able to utilise them. It would be more logical to ensure they are able to locate and use resources that appraise the evidence ready for use in clinical practice (such as the Cochrane Database of Systematic Reviews) or are aware where to send clinical questions for a "bottom line treatment" option to be presented (such as BestBETS and ATTRACT).

6.3 Contributions to the Literature

The actual information need figures identified in this research (approximately one question for every four patients) may not accurately reflect the number of questions asked by doctors in the UK, particularly as a previously untested data collection technique, namely the clinical librarians' log, was utilised. For example, one clinical librarian pointed out that questions were also raised outside the clinical meeting, by telephone or e-mail. These were not included in this research. Further research is needed to corroborate and validate these results or repudiate them. However, despite this caveat, this research does confirm that doctors practising in the UK do have quantifiable, identifiable clinical information needs as this research has focussed on the UK whilst the previous literature focussed on the USA.

A unique method for collecting data was employed in this research. Utilising clinical librarians as data collectors has enabled the "unperceived needs" of doctors in the acute-sector to be identified and quantified. The Clinical Librarian as a "participant" observer data collector worked in most situations. However if the Clinical Librarian was inexperienced generally or rarely involved with a particular team (either as this was a one-off or they were new to the role) then they could not really be considered an established member of the team. This was then reflected in their below average responses with their data collection. The Clinical Librarian role is very specialised. However, the principle of using an established member of a group to act as data collector should be transferable, for example a minute taker at meetings or a teaching assistant in a classroom. Basically any individual established in a team could be recruited to unobtrusively observe or monitor the information needs and behaviours of the other team members, with minimal "observational" impact.

The analysis utilising the taxonomy by Ely et al. (2000) and comparing the results of this study to that study suggest there is more correlation within the country (and medical disciplines in that country) than there is between the same medical disciplines in different countries. In other words, there was more correlation between GPs and acute sector doctors in the UK than between GPs in the UK and primary care doctors in the USA.

This research added new categories to the taxonomy developed by Ely et al. (2000).

The URL of the online questionnaire was e-mailed out to doctors as a personalised (not a mail shot) e-mail. This was a time-consuming task, both in locating current active e-mail addresses for doctors and in actually sending out the e-mails. However the response rate was excellent, 27% compared to the 11% achieved in other published research. There are four possibilities for this higher response rate:

- The personalised nature of the e-mails inviting the doctors to participate was appreciated rather than the general e-mail "Dear Doctor".
- The doctors had not completed many online user-friendly questionnaires and so were willing to try it (especially since it took less than ten minutes to complete).
- The doctors contacted may have been interested in the subject area.
- The target audience was reached by the e-mails.

This research is the first cross-sector (both primary and acute) study of doctors understanding of EBM and information-seeking behaviour.

This research identified that resources that had only ever been electronic were not widely known about. This suggests there are marketing and promoting issues.

6.4 Further Research

The Clinical Librarian who attends clinical meetings or ward rounds can act as a data collector, "participant" observer. This should be transferable to study Clinical Librarians in other countries, such as the Netherlands, Sweden and the USA if their Clinical Librarians undertake similar roles. This would be particularly useful for comparing the "unperceived needs" of doctors.

The key finding from this research is that results from the USA in information needs and information-seeking behaviour are not comparable to the UK. Comparisons of this sort have not been undertaken in this area before, and therefore further investigations are warranted.

This research collected data from different sources to answer the different sections on evidence-based medicine information needs and information-seeking behaviour. Following the same three phases with the same doctor(s) would give the complete picture from an individual(s) point of view. The doctors would need to be observed to identify the frequency of their information need, to determine which questions were followed up and how the information, if searched for, was located. This data collection method could then continue on to determine the success of the search and its impact on patient care. This research would be intrusive and labour-intensive requiring a major commitment from the researcher(s) and doctor(s). Ethical approval would be potentially difficult to obtain in the NHS.

The differences in responses to the EBM terms and electronic resources doctors utilise suggest that an evaluation of EBM courses and their content would provide data that could be compared to this research. The availability of EBM courses to all medical doctors is also worth evaluating to determine if these courses are marketed in a suitable manner for all doctors, especially GPs.

The list of evidence based medicine resources listed on the questionnaire was never intended to be exhaustive. Such a list would have been so long that it would have been a massive potential barrier to respondents. However, the e-mail responses to the questionnaire suggested other resources that were used by these individual doctors, including specialised resources. A further research project could determine the doctors' preferred electronic resources in a "free text" manner, enabling them to identify resources they use (and why). This would generate a comprehensive list of resources actually used by practitioners. These could then be evaluated by health and information professionals to determine their relevance, suitability and validity in providing accurate, impartial healthcare information. This validated list could then be hosted on by the National Library for Health as an "authorised" list of resources.

7 APPENDIX I: Ely's Taxonomy

From: Ely, J.W., Osheroff, J.A., Gorman, P.N., Ebell, M.H., Chambliss, M.L., Pifer, E.A. & Stavri, P.Z., 2000. A taxonomy of generic clinical questions: Classification study. *British Medical Journal*, 321(7258), 429-32.

Code	Primary	Secondary	Tertiary / Quaternary	Generic type
1.1.1.1	diagnosis	cause / interpretation of clinical finding	symptom	What is the cause of symptom x? OR What is the differential diagnosis of symptom x? OR Could symptom x be condition y or be a result of condition y? OR What is the likelihood that symptom x is coming from condition y?
1.1.2.1	diagnosis	cause / interpretation of clinical finding	sign	What is the cause of physical finding x? OR What is the differential diagnosis of physical finding x? OR Could physical finding x be condition y or be a result of condition y? OR What is the likelihood that sign x is coming from condition y? OR At what level does physical finding x become clinically important? OR What is considered normal for physical finding x?
1.1.3.1	diagnosis	cause / interpretation of	test finding (lab, ECG, imaging,	What is the cause of test finding x? OR What is the differential diagnosis of test finding x? OR Could test finding x be condition y

		clinical finding	biopsy, skin test, etc.)	or be a result of condition y? OR What is the likelihood that test finding x is coming from condition y? OR How should I interpret test finding(s) x? OR How should I use test finding x in my decision? OR At what level does the value of test x become clinically important? OR What are the normal values (reference range) of test x?
1.1.4.1	diagnosis	cause / interpretation of clinical finding	unspecified findings or multiple categories of findings	Could this patient have condition y (given findings x1, x2, ... xn)? OR What is the likelihood that this patient has condition y (given findings x1, x2, ... xn)? OR What does this patient have (given findings x1, x2, ... xn)? OR What is the differential diagnosis of these findings?
1.2.1.1	diagnosis	criteria / manifestations		What are the manifestations (findings) of condition y? OR What is condition y? OR What does condition y look like? OR What are the criteria for diagnosis of condition y? OR How do I diagnose condition y (based on information I have or could get)? OR How do I distinguish between conditions y1, y2, ... yn (based on information I have or could get)? OR How can you tell if the patient has condition y (based on information I have or could get)? OR Can condition y cause manifestation (finding) x? OR How does

				condition y cause manifestation (finding) x? OR Why did condition y cause manifestation (finding) x? OR Can condition y present with (as) manifestation (finding) x?
1.3.1.1	diagnosis	test (lab, skin test, biopsy, imaging, element of physical exam, etc)	indications / efficacy	Is test x indicated in situation y? OR What test (or evaluation, or work up), if any, is indicated/appropriate in situation y or with clinical findings x1, x2, … xn? OR What is the best test in situation y? OR Do the benefits of doing test x (work up x) outweigh the risks? OR How do I diagnose condition y (meaning what test(s) or work up should I do)? OR How do I distinguish between conditions y1, y2, yn (meaning what test(s) or work up should I do)? OR How can you tell if the patient has condition y (meaning what test(s) or work up should I do)? OR Should this kind of patient have screening test x? OR What screening tests should this patient have?
1.3.2.1	diagnosis	test (lab, skin test, biopsy, imaging, element of physical exam, etc)	accuracy	How good is test x in situation y? OR What are the performance characteristics (sensitivity, specificity, etc.) of test x in situation y? OR What is the efficacy of screening with test x? OR What is the efficacy of screening for condition y?

1.3.3.1	diagnosis	test (lab, skin test, biopsy, imaging, element of physical exam, etc)	timing / monitoring	When (timing, not indications) should I do test x? OR When (timing, not indications) should I do test x to monitor condition y? OR When (timing, not indications) or how often should screening test x be done? OR When (timing, not indications) or how often should you screen for condition y?
1.3.4.1	diagnosis	test (lab, skin test, biopsy, imaging, element of physical exam, etc)	preparation	What is the preparation for test x?
1.3.5.1	diagnosis	test (lab, skin test, biopsy, imaging, element of physical exam, etc)	method	How do you do test x? OR What is the best way (best technique, best method) to do test x or screening test x?
1.4.1.1	diagnosis	name finding	body part (anatomy)	What is the name of this body part? OR What is the anatomy here?

			on physical exam or imaging study	
1.4.2.1	diagnosis	name finding	condition	What is the name of that condition?
1.4.3.1	diagnosis	name finding	test	What is the name of that test?
1.5.1.1	diagnosis	orientation	condition	What is condition y?
1.5.2.1	diagnosis	orientation	test	What is test x?
1.6.1.1	diagnosis	inconsistencies		Why were this patient's findings (or course) inconsistent with usual expectations?
1.7.1.1	diagnosis	cost		What is the cost of test x?
1.8.1.1	diagnosis	not classified elsewhere		Generic type varies.
2.1.1.1	treatment	drug prescribing	how to prescribe / undifferentiated	How do you prescribe/administer drug x (in situation y)?
2.1.1.2	treatment	drug prescribing	how to prescribe / dosage	What is the dose of drug x (in situation y)? OR Should I change the dose of drug x (in situation y)? OR What is the maximum dose of drug x (in situation y)? OR What are equivalent doses among members of drug class x?
2.1.1.3	treatment	drug prescribing	how to prescribe /	When (timing, not indication) or how should I start/stop drug x? OR

			timing	How long should I give drug x? OR When (timing, not indication) should I give drug x (in situation y)?
2.1.2.1	treatment	drug prescribing	efficacy / indications / drug of choice / treatment	Is drug x (or drug class x) indicated in situation y or for condition y? OR What are the indications for drug x? OR Is any drug indicated for situation y? OR Does drug x work for condition y? OR How effective is drug x for condition y? OR What is the drug of choice for situation y or for condition y? OR What are the options for drug treatment of situation y or condition y? OR Is drug x1 better than drug x2, x3, ... xn for condition y? OR Is drug x1 just as effective as drug x2 (in situation y)? OR Does the benefit of giving drug x outweigh the risk?
2.1.2.2	treatment	drug prescribing	efficacy / indications / drug of choice / prevention	Should this kind of patient get prophylactic drug x to prevent condition y? OR Is prophylactic drug x indicated to prevent condition y? OR What prophylactic drug should I give to prevent condition y? OR How effective is prophylactic drug x in preventing condition y? OR For how long is drug x effective in preventing condition y? OR Is prophylactic drug x1 better than prophylactic drug x2 in preventing condition y?
2.1.3.1	treatment	drug prescribing	adverse effects /	Could finding y be caused by drug x? OR Does drug x cause finding

			findings caused by drug / adverse effects of drug	y? OR What are the adverse effects of (or risks of using) drug x? OR What is the likelihood (incidence) of adverse effect(s) y resulting from drug x? OR How long do the adverse effects from drug x last after stopping it? OR Which drug has the fewest adverse effects? OR Are there differences among drugs x1, x2, ... xn in their likelihood of causing adverse effect(s) y?
2.1.3.2	treatment	drug prescribing	adverse effects / administration in face of adverse effects	How can drug x be administered without causing adverse effect y or minimizing adverse effect y or in spite of adverse effect y? OR What dose of drug x would cause adverse effect y or any adverse effect?
2.1.3.3	treatment	drug prescribing	adverse effects / safety / contraindications (includes pregnancy and breast feeding)	Is drug x safe to use in situation y? OR Is drug x contraindicated in situation y?
2.1.4.1	treatment	drug prescribing	interactions	Is it OK to use drug x with drug y? OR Are there any interactions between drug x1 and drug (or food) x2, x3, ... xn?
2.1.5.1	treatment	drug prescribing	name finding	What is the name of that drug?
2.1.6.1	treatment	drug prescribing	orientation /	What is drug x? OR What is in drug x (or dietary product x)? OR

			composition	How much of component y is in drug x?
2.1.7.1	treatment	drug prescribing	physical characteristics	What are the physical characteristics (dosage forms, tablet/liquid characteristics, container characteristics) of drug x?
2.1.8.1	treatment	drug prescribing	pharmaco-dynamics/ absorption	What are the pharmacodynamic/ absorption characteristics of drug x? OR How do the pharmacodynamic/ absorption characteristics of drugs x1, x2, ... xn compare?
2.1.9.1	treatment	drug prescribing	mechanism of action	What is the mechanism of action of drug x? OR How does drug x work?
2.1.10.1	treatment	drug prescribing	cost	What is the cost of drug x? OR How does the cost of drug x1 compare with the cost of drug x2, x3, … xn?
2.1.11.1	treatment	drug prescribing	serum levels	What are the indications for getting a drug serum level or what time should it be drawn or how often should it be drawn?
2.1.12.1	treatment	drug prescribing	availability	Is drug x available yet? OR Is drug x available over-the-counter?
2.2.1.1	treatment	not limited to but may include drug prescribing	efficacy / indications / treatment	How should I treat finding/condition y (given situation z)? OR Should I use treatment/procedure x for condition/finding y? OR What is the efficacy of treatment/procedure x (for condition y)? OR Does procedure/treatment x work (for condition y)? OR Is treatment/procedure x indicated (for condition y)? OR What is the best treatment/procedure to do (for condition y)? OR Does the

				benefit of treatment/procedure x outweigh the risk? OR What are the options for treatment of condition y (in situation z)? OR Is there any treatment for condition y? OR What is the goal of treatment of condition y? OR At what level of severity of condition y is treatment indicated?
2.2.1.2	treatment	not limited to but may include drug prescribing	efficacy / indications / prevention	Should this kind of patient get prophylactic treatment (intervention) x to prevent condition y? OR Is prophylactic treatment (intervention) x indicated to prevent condition y? OR What prophylactic treatment (intervention) should I give to prevent condition y? OR Does treating condition y1 help prevent condition y2?
2.2.2.1	treatment	not limited to but may include drug prescribing	timing	When (or how) should I start/stop treatment x? OR When (timing, not indication) should I use treatment x (in situation y)? OR How long should I continue treatment x for condition y?
2.2.3.1	treatment	not limited to but may include drug prescribing	how to do it	How do you do treatment/procedure x? OR What is the best way to do treatment/procedure x?
2.2.4.1	treatment	not limited to but may include	principles / rationale	What are the principles (or rationale) behind therapy x? OR How does therapy x work?

		drug prescribing		
2.3.1.1	treatment	not classified elsewhere		Generic type varies.
3.1.1.1	management	condition / finding		How should I manage condition/finding/situation y? (not specifying diagnostic or therapeutic management) OR What management options are there in situation y? OR How aggressive / conservative should I be in situation y?
3.2.1.1	management	other providers	practices of other providers	Why did provider x treat the patient this way? OR How do other providers manage condition y?
3.2.2.1	management	other providers	referral	When should you refer in situation y?
3.2.3.1	management	other providers	community services	What social services (or support groups, community groups) are available for condition/situation y?
3.3.1.1	management	doctor-patient communication	how to advise	How should I advise the patient/family in situation y?
3.3.2.1	management	doctor-patient communication	how to approach difficult issue	What is the best way to discuss or approach discussion of difficult issue x?
3.3.3.1	management	doctor-patient communication	patient compliance	How can I get the patient/family to comply with my recommendations or agree with my assessment?
3.4.1.1	management	not classified		Generic type varies.

		elsewhere		
4.1.1.1	epidemiology	prevalence / incidence		What is the incidence/prevalence of condition y (in situation z)? OR Why is the incidence/prevalence of condition y changing?
4.2.1.1	epidemiology	etiology	causation / association / risk factors / disease agents	Is x a risk factor for condition y? OR Is x associated with condition y? OR Is condition y1 associated with condition y2, y3, ... yn (all conditions present at the same time)? OR Can finding or disease-agent x cause condition y? OR What are the causes of condition y? OR What conditions or risk factors are associated with condition y? OR Why did the patient get condition y?
4.2.1.2	epidemiology	etiology	causation / association / genetics	Is condition y hereditary?
4.3.1.1	epidemiology	course / prognosis		What is the usual course (or natural history) of condition y? OR What is the prognosis (or likelihood of complications) of condition/situation y? OR Can condition y1 lead to condition y2, y3, ... yn (condition y1 occurs before conditions y2, y3, ... yn)?
4.4.1.1	epidemiology	not classified elsewhere		Generic type varies.
5.1.1.1	non clinical	education	provider / continuing medical education	I need to learn more about topic x. OR I need to review topic x.

5.1.1.2	non clinical	education	provider / information source	Where can I find or how can I get information about topic x? OR Is there any information on topic x?
5.1.1.3	non clinical	education	provider / trainee	How can I better teach this trainee (medical student, resident, other provider)?
5.1.2.1	non clinical	education	patient	What patient education materials are available for situation y? OR Where can I get patient education materials on topic x?
5.2.1.1	non clinical	administration		What are the administrative rules/ considerations in situation y? OR What are the local requirements and issues relevant to situation y? OR What are the safety issues for health care workers in situation y?
5.3.1.1	non clinical	ethics		What are the ethical considerations in situation y?
5.4.1.1	non clinical	legal		What are the legal considerations in situation y?
5.5.1.1	non clinical	frustration		Generic type varies. Not a true question, but rather an expression of frustration or an unanswerable dilemma.
5.6.1.1	non clinical	not classified elsewhere		In a broad sense, the question is non clinical, but it does not fit any other non clinical category.
6.1.1.1	unclassified			Generic type varies. Unable to classify.

8 APPENDIX II: EBM Resources

8.1 Resources Listed on Questionnaire

8.1.1 Bandolier (Oxford, UK) - http://www.jr2.ox.ac.uk/bandolier/

Bandolier is a free electronic synthesised resource. All of the back issues of the Bandolier Journal are available from the website. The format is simple so that content can be rapidly accessed over the slowest modem. In 1999 the electronic and paper versions of Bandolier were separated and some of the material on the web site has not appeared in the print version. The Bandolier Journal is available in print for a subscription. The journals appear on the website six months after the print version. The website is maintained through sponsorship, though this has not been allowed to affect the content of the site.

The first issue of Bandolier, an independent journal on evidence-based healthcare, was printed in February 1994. It has appeared monthly since then. The articles appear first in the paper version and after approximately two months, on the website (that was launched in 1995).

Bandolier focuses on the evidence of effectiveness (or lack of it), and the results are bullet points listing those that worked and those that did not. The information used is from systematic reviews, meta-analyses, randomised controlled trials, and from high quality observational studies.

8.1.2 BestBETs (Manchester, UK) - http://www.bestbets.org

BestBETs is a free synthesised resource. BETs are published both electronically and in paper form. The BestBETs website also includes an appraisal tool checklist.

BETs (Best Evidence Topic) developed in the Emergency Department of Manchester Royal Infirmary, UK, in 1996. It aims to provide evidence-based answers to specific clinical questions.

BETs use a systematic approach that is reproducible and explicit. The shortcomings of current evidence are acknowledged and BETs use lower quality research, listing the shortcomings of the evidence used. Each BET has a clinical "bottom line" for the busy doctor.

BETs initially had an emergency medicine focus, but there are now a significant number covering cardiothoracic, primary care and paediatrics. There are over 800 registered questions. Each BETs is dated so its currency is easy to determine. Although not currently formalised many BETs have been and are regularly updated. Recent changes can be identified by a specific icon on the database page.

8.1.3 CAT Resources

These are free appraised resources.

A CAT summarises an individual item of evidence and presents the results in an easily digestible format. CATs are patient-based and evidence-based. They are concise and portable. CATs do have limitations:

- Individual CATs might be wrong.
- CATs by their nature only contain a single element of the relevant literature and another article may contain conflicting information.
- CATs may have a short shelf-life.

Individual CATs may have a short shelf life, becoming out of date when new evidence becomes available, unless the CAT is subsequently redone with the new information. Therefore CATs should really be uses as starting points. To assist updating, specifying the exact search strategy and "sell-by" dates after which their CATs should be considered obsolete.

8.1.3.1 CATBank - http://www.cebm.net/cats.asp

The CATBank is a collection of CATs (Critically Appraised Topics). The CATBank is currently offline pending updating, though it is possible to link through to the old site, which still contains the original 63 CATs. This is available for free.

8.1.3.2 CAT Crawler - http://www.bii-sg.org/research/mig/cat_search.asp

The CAT Crawler is a one-stop meta-search engine that searches popular online CAT libraries from the UK, Australia, New Zealand, Singapore, Canada and the USA (including BestBETs and CATBank) and provides relevant CATs to a particular clinical topic. This is available to search and locate the relevant information at no charge.

8.1.3.3 University of North Carolina - http://www.med.unc.edu/medicine/edursrc/!catlist.htm

This website contains an alphabetical listing of CATs.

8.1.3.4 University of Michigan - http://www.med.umich.edu/pediatrics/ebm/Cat.htm

Paediatric CATs are listed under the headings of cardiology, emergency paediatrics, endocrinology, gastroenterology, general paediatrics/behavioural, haematology/oncology, infectious diseases, neonatology, neurology, nephrology and pulmonary.

8.1.4 Clinical Evidence (BMJ) - http://www.clinicalevidence.com/ceweb/conditions/index.jsp

Clinical Evidence is a free synthesised resource aimed at both the primary and acute sector. Clinical Evidence is currently available in five formats; the full text book, the Concise book, the CD-ROM, a version for PDA and the website. Previously, the UK National Health Service distributed 50,000 copies of Clinical Evidence Concise to staff in England and provided free online access in England and Wales to healthcare professionals and patients. However, currently only NHS Staff in Scotland and Wales have online access (and the BMA distribute the handbook annually to 10,500 medical students).
This resource was first published by the BMJ Publishing Group in collaboration with the American College of Physicians–American Society of Internal Medicine

in 1999. It promotes informed decision-making by summarising what's known and what is not known about over 200 medical conditions and more than 2000 treatments. In order to maximise its usefulness, Clinical Evidence aimed for highly relevant and valid information which is low work in terms of the time and effort required by the reader. Transparency was maintained by ensuring users are aware where the information came from and how it has been appraised. The information provided is explicit and utilises the hierarchy of evidence developed by Clinical Evidence which focuses on the research results:

- Evidence that products are beneficial;
- Evidence that products are likely to be beneficial;
- Evidence of a trade-off between benefits and harms;
- Unknown effectiveness;
- Products are unlikely to be beneficial;
- Evidence that products are likely to be ineffective or harmful.

Clinical Evidence has several unique features:

- The content is driven by questions rather than starting with the research evidence.
- It only identifies the gaps in the evidence.
- It is continuously updated, with full literature searches in each topic annually. Print copies are published every six months and the website updated every month.

8.1.5 Cochrane Collaboration - http://www.nelh.nhs.uk/cochrane.asp

The Cochrane Library is a free synthesised resource. In April 2002, The Cochrane Library was made free at the point of use to anyone with Internet access in England (via the National Library for Health), at which point it became easily accessible for all healthcare professionals.

"The Cochrane Centre" started in October 1992 and the following year The Cochrane Collaboration was launched. The Cochrane Collection is now a world-wide, independent, not-for-profit organisation. Its primary aim is to produce and disseminate systematic reviews of healthcare interventions. The Cochrane

Collaboration was named for the British epidemiologist, Archie Cochrane, who published "Effectiveness and Efficiency: random reflections on health services" in 1972, highlighting lack of knowledge about the impact of health care.

The reviews are mainly prepared by health care professionals who volunteer to be part of a Collaborative Review Group. Editorial teams oversee the preparation and updating of the reviews, ensuring standards are maintained.

In April 1995 The Cochrane Database of Systematic Reviews was launched. In April 1996 The Cochrane Library was launched as a quarterly publication on CD-ROM and disk, including The Cochrane Database of Systematic Reviews, The Database of Abstracts of Reviews of Effects, The Cochrane Controlled Trials Register and The Cochrane Review Methodology Database. The Cochrane Database of Systematic Reviews was made available on the World Wide Web in September 1996.

DATE	NUMBER OF PUBLISHED REVIEWS
January 2001	Published Cochrane reviews reach 1000 in The Cochrane Library
June 2003	Published Cochrane protocols and reviews reach 3000
July 2004	Published Cochrane reviews reach 2000 in The Cochrane Library (Issue 3, 2004)

8.1.6 Drug and Therapeutics Bulletin (UK) - http://www.dtb.org.uk/idtb/

This is a subscription-based synthesised resource.

The Bulletin was previously available in paper form by subscription and electronically via the National Library for Health (with NHS Athens authentication). However the electronic version is no longer freely available to NHS staff in England.

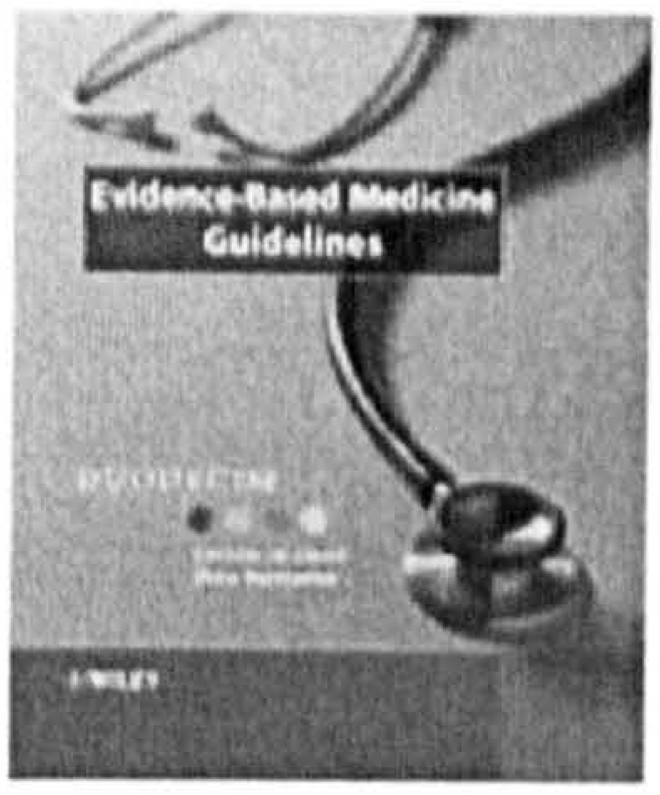
The Drug and Therapeutics Bulletin began in 1963, providing healthcare professionals with practical and impartial advice to ensure that patients receive the best possible care. The DTB aims to provide unbiased assessments of drugs and other treatments, focussing on their efficacy, safety, convenience and cost, particularly compared to other treatments. It is published monthly by Which? and provides articles on the assessment of the evidence with opinions from a wide

range of experts (up to 100 individuals and organisations for each article). The published research used is mentioned in the conclusions so the user is able locate the original studies.
Articles that are researched arise from reports in journals, drug company promotions, readers' letters and problems encountered in clinical practice. An article can take several months to produce from the time of commissioning. However, articles can be "fast tracked" when necessary, such as the launch of a potentially important new drug. Most of the information used in the articles is from randomised double-blind controlled trials, systematic reviews or meta-analyses that have been published in peer-reviewed journals in full-text. Information is included from national bodies (for example, the British National Formulary) and national organisations (such as NICE).

8.1.7 DynaMed - http://www.dynamicmedical.com

DynaMed (Dynamic Medical Information System) is a subscription-based synthesised resource. There are various subscription rates for individuals, from the standard to effort based (where reviewing a summary will earn six months access and authoring a year's access).
This is a medical reference system designed for use at the point of care in primary care. It contains clinically organized summaries of nearly 3,000 topics and is updated daily from reviews of the research literature.
In addition to the "mainstream" information found in many reference materials, DynaMed provides information from smaller studies and anecdotal information. This is presented as an "objective" summary of the data with references for those who wish to explore the area further.
DynaMed is available in a PDA application for Palm OS and Microsoft Mobile devices.

8.1.8 EBM Guidelines - http://www.ebm-guidelines.com/kotisivut/sivut.koti?p_sivusto=57



This is a subscription-based synthesised resource. EBM Guidelines is available on the Internet, CD and PDA via subscription. Evidence-Based Medicine Guidelines was also published as a book in January 2005.

The idea of EBM Guidelines emerged in 1987. EBM Guidelines is a collection of concise and easy-to-use clinical guidelines for primary care evidence. The first electronic version was published in 1989. The contents of the database are updated three times a year. Over the years the guidelines have been reviewed extensively to include evidence from clinical studies and comments by external referees. The collection includes over 1,000 primary care practice guidelines; over 2,000 evidence summaries with recommendations; hundreds of high-quality photographs; and all cited Cochrane reviews in full text.

Specifically, the EBM Guidelines provide:

- Detailed recommendations on diagnostic tests and drug dosage
- Guidelines that are planned to be read on computer screen

8.1.9 Evidence Based On-Call (UK) - http://www.eboncall.org/

Evidence-Based On-Call is a free synthesised resource.

This database is designed for hospital doctors. Each topic provides a series of recommendations about issues to consider when caring for patients.

The website comprises two sections: Guides and CATs. A CAT (Critically Appraised Topic) is a summary of the evidence contained in a medical journal article. To maintain consistency, these CATs have a strictly defined structure. Guides provide bullet-point recommendations on the diagnosis and management of a range of on-call conditions. Each guide is divided into sections, such as diagnosis, therapy and prognosis. Each section is made up of a series of recommendations, with information on the levels of evidence supporting them.

8.1.10 Health Technology Assessments (UK) - http://www.hta.nhsweb.nhs.uk/

Health Technology Assessments (HTAs) are a free synthesised resource.
The HTA programme aims to ensure high quality research on the costs, effectiveness and broader impact of health technologies is produced in an effective way for those who provide and manage patient care. The definition of "health technologies" is broad enough to include all interventions that promote health, prevent or treat disease and improve rehabilitation and long-term care. This covers new equipment, the use of pharmaceuticals, medical procedures and healthcare settings.
The HTA asks four basic questions:

- Does the technology (intervention) work?
- For whom?
- At what cost?
- How does it compare with the alternatives?

From the suggestions received by the HTA Programme each year, around thirty are commissioned for research. The research is overseen to ensure it is well-designed, is cost effective, uses suitable protocols and answers the specific research needs. Expert peer reviewers assist in reaching the final conclusions.
A CD ROM of the full HTA monographs is available, free of charge, to anyone working in the public sector (including non-commercial charities). The HTA Internet site is mirrored on the NHSnet. It allows users to put forward suggestions for future research and download the full text of monograph reports for free.

8.1.11 InfoPOEMs and InfoRetriever - http://www.infopoems.com/

InfoPOEMs and InfoRetriever are a subscription-based synthesised resource aimed at primary care doctors.
Since 1996, the system of Daily InfoPOEMs e-mail alerts and the InfoRetriever database has been providing practicing doctors the information they need when they need it in their clinical practice. InfoRetriever also contains more than 200 decision support tools and more than 2,200 diagnostic calculators.

Daily InfoPOEMs® point out valid, relevant research via daily e-mail synopses every Monday through Friday. Each InfoPOEM is also added to the InfoRetriever database, for easy future reference. More than 1,200 studies are reviewed monthly from over 100 journals.
InfoRetriever is available on handhelds as well as online.

8.1.12 MDConsult - http://www.mdconsult.com/offers/standard.html

MDConsult is a subscription-based synthesised resource.
This resource is produced by Elsevier and provides electronic information resources that meet the clinical content needs of doctors.
FIRST Consult provides point of care decision support for diagnosis, therapy and management. It is an evidence-based, continuously updated resource, designed to give rapid access to concise information.
POCKETConsult can assist in the management of PDA resources. It offers access to medical calculators, medical news, drug updates and abstracts from Elsevier journals.

8.1.13 Medline - http://www.library.nhs.uk/Default.aspx?ref=at

Medline is a subscription-based primary resource. The database is available via NHSnet and the Internet through the National Library for Health (with NHS Athens authentication). This allows access to full-text articles for which the NHS has subscribed.
The printed publication, Index Medicus, was started by John Shaw Billings in 1879. Computer technology was first used by the National Library of Medicine (Washington DC, USA) in 1960 to speed up the annual production of Index Medicus. From this development came MEDLARS (Medical Literature Analysis and Retrieval System). This was introduced in 1964. Its system batch searched accumulated requests which could take several weeks, but was still an improvement over manual searching. The development of computer technologies led to the introduction of MEDLINE (MEDLARS-ONLINE) in 1973. This was one of the first on-line databases to become available publicly. Any individual

with access to a suitable computer (and link to the telecommunications network) could access the database and search for themselves, remaining in full control over the search. Medline covers journals from seventy countries (60% written in English). However, it is an American database, so there remains a strong American-bias. The database is indexed using MeSH headings which allow controlled searching and is updated annually to keep pace with new developments.

8.1.14NICE Guidance (UK) - http://guidance.nice.org.uk/

NICE guidance is a free synthesised resource.

The National Institute for Health and Clinical Excellence (NICE) is an independent organisation responsible for providing national guidance.

NICE produces guidance in three areas of health:

- Public health - guidance on the promotion of good health and the prevention of ill health;
- Health technologies - guidance on the use of new and existing medicines, treatments and procedures within the NHS;
- Clinical practice - guidance on the appropriate treatment of specific conditions and diseases.

8.1.15PubMed - http://www.ncbi.nlm.nih.gov/entrez/query.fcgi

PubMed is a free primary resource.

The National Library of Medicine launched PubMed Central in 1996 and was redesigned in 2000. It allows any individual with access to the Internet to search Medline at no cost to the user. Abstracts are included where available and some articles are even full-text (at no charge). PubMed also contains:

- Some life science journals that submit full text to PubMedCentral® and may not have been recommended for inclusion in MEDLINE
- Links to many sites providing full text articles and other related resources
- The useful "find related" links feature

- Clinical queries - http://www.ncbi.nlm.nih.gov/entrez/query/static/clinical.shtml. There are five categories - therapy, diagnosis, etiology, prognosis and clinical prediction guides. The search can be more sensitive (most relevant articles but probably some less relevant ones) or more specific (mostly relevant articles but probably omits a few).
- The Cancerlit link means that the results will be automatically limited to cancer-related citations in PubMed http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed&orig_db=PubMed&cmd_current=Limits&pmfilter_Subsets=Cancer.
- A new feature is PubMed for Handhelds (http://pubmedhh.nlm.nih.gov). It can be searched via PICO format (http://pubmedhh.nlm.nih.gov/nlm/pico/piconew.html). It works on any computer or handheld device with real-time Internet connection.

The disadvantage with this resource is that it provides a "map of the literature" rather than the literature content (Henderson, 2005, p.1550). The quantity of information available can overwhelm users.

8.1.16TRIP database (UK) - http://www.tripdatabase.com

TRIP (Turning Research Into Practice) is a free synthesised resource. The database is again freely available to all Internet users (after a short period with a subscription charge that has now been discontinued).

TRIP was launched in 1997 providing access to top health care publications relevant to clinical practice in one place. The results from searches provide full-text guidelines and reviews in EBM sources. However, complex searches are difficult (Henderson, 2005).

8.1.17UpToDate - http://www.uptodate.com/

UpToDate is a subscription-based synthesised resource. UpToDate is designed to answer the clinical questions that arise in daily practice quickly and easily so it can be used right at the point of care. The content is updated continuously and a new, peer-reviewed version is issued every four months. The content focuses on certain specialisms based in the acute sector, such as cardiovascular medicine, endocrinology, infectious diseases, obstetrics, oncology and rheumatology. The topic reviews are written by doctors for doctors. The content is comprehensive but concise and is fully referenced. The published evidence is summarized and specific recommendations made directly for patient care. There is extensive peer review to ensure the information is accurate and reliable. However, it is worth noting that the evidence used for these topics are not from a full systematic review of the literature.

UpToDate is a comprehensive evidence-based clinical information resource available to doctors on the Internet, CD-ROM, and Pocket PC. UpToDate receives no commercial backing or sponsorship from any organization and is available via subscription.

8.2 Resources Identified by Questionnaire Respondents

8.2.1 DermNet NZ: Dermatology Resource - http://www.dermnetnz.org/

This is the website of the New Zealand Dermatological Society Incorporated, launched in March 1996. The site aims to present authoritative facts about the skin for consumers and health professionals. DermNet NZ is funded by advertising, non-directed sponsorship, members' directory listings, image sales and product sales. The information on the website is freely available on the Internet. Dr SH emailed "this [website] is patient friendly and I refer my patients to it as well as using it for decision support and explanation to the patient in the clinic."

8.2.2 GANFYD - http://www.ganfyd.org/index.php?title=Main_Page

The free medical knowledge base that anyone can read and any registered medical practitioner may edit. The site is based around the wiki format, enabling true sharing of knowledge. Simply put this is an evolving textbook of medicine. The medium (computers and the Web) removes some of the limitations of conventional paper-based texts.

8.2.3 GP Notebook - http://www.gpnotebook.co.uk/homepage.cfm

The content is based on clinical practice in the United Kingdom and provides a clinical reference guide for GPs. The database is continually updated by a team of authors. Editorial decisions are based on merit and not influenced by any funding bodies. The information is freely available on the Internet. Dr WH e-mailed this "is a really good electronic resource that can be used during a consultation. It is basic but quick."

8.2.4 Mentor - http://www.webmentorlibrary.com/WMLlogin.asp

Mentor is a diagnostic decision support tool available to the UK primary healthcare market. Mentor includes a drugs database, patient information leaflets, reference tools, calculators, scales and on online knowledge support system containing evidence-based information for medical decision-making. The system is available to approximately half the GPs as part of their clinical system (EMIS). Alternatively there is a annual subscription of less than £100.

8.2.5 Patient UK – http://www.patient.co.uk

This is a comprehensive, free, up-to-date health information as provided by GPs to patients during consultations, aimed at patients. Dr WH e-mailed this "is quick and very good for patient information to print out in consultations."

8.3 Other Resources Mentioned in the Text

8.3.1 British National Formulary (BNF) - http://www.bnf.org/bnf/

The BNF provides UK healthcare professionals with clear practical information on the selection and clinical use of medicines in a concise and accessible manner. It is a joint publication of the British Medical Association and the Royal Pharmaceutical Society of Great Britain. The BNF book is published biannually and aims to provide up-to-date information about the use of medicines. The current edition must always be used for making clinical decisions. The more important changes for this edition are listed under "significant changes". It is designed as a digest for rapid reference and it does not always include all the information necessary for prescribing and dispensing.

Information about drugs is drawn from the manufacturers' product literature, medical and pharmaceutical literature, regulatory /professional authorities and data used for pricing prescriptions. The website includes additional information of relevance to healthcare professionals dealing with medicines. To access the BNF online requires a subscription.

9 APPENDIX III: E-mail Request for Clinical Questions

Dear

I am currently collecting data for my PhD on the information needs of qualified medical staff.

Do you undertake literature searches on clinical questions from qualified doctors in the acute or primary sector? Would you be willing to send me these questions so that I can analyse them using Ely's taxonomy? I am looking for between five and fifty questions, from as many sources as possible. All of the data received will be kept confidential and anonymous. The text of the questions will not be used in the final thesis, only the analysis e.g. treatment, diagnosis, etc.

If you have any questions please do not hesitate to contact me at K.S.Davies@lboro.ac.uk

Thanks

Karen

10 APPENDIX IV: Research Questionnaire Instrument

Thank you for taking the time to complete this questionnaire, which should take approximately ten minutes to complete. The information is required for my PhD on the "information needs of qualified doctors".

DEMOGRAPHIC DATA

Year of medical school graduation	

MEDICAL SPECIALISM	A&E	
	Anaesthetics	
	Cardiothoracic	
	Cosmetic and Plastic Surgery	
	Critical Care	
	Dermatology	
	Ear, Nose and Throat	
	Endocrinology	
	Gastroenterology	
	General Practice	
	Geriatrics or Elderly Medicine	
	Haematology	
	Immunology and Allergy	
	Infectious and Communicable Diseases	
	Neurology	
	Obstetrics, Gynaecology and Fertility	
	Oncology	
	Ophthalmology	
	Orthodontics	
	Orthopaedics	

	Paediatrics	
	Pain Management	
	Palliative Care	
	Pathology	
	Psychiatry	
	Public Health	
	Respiratory Medicine	
	Rheumatology	
	Sexual Health	
	Surgery	
	Urology	
	Other (please specify)	

COUNTRY	UK	
	Canada	
	USA	
	Other (please specify)	

NEED FOR INFORMATION

Which of the following information needs do you access electronically? (Please select all that apply)			
	All the time	Sometimes	Never
Information to assist with diagnosis			
Treatment options for common diseases			
Information on rare diseases and syndromes			
Drug information (including new drugs and contraindications)			
Information to give to patients			
Information for study for further qualifications			
Continuing professional development			

Research			
Teaching			

How often on average do you formulate specific questions that require searching external evidence?	
Less than once a month	
Less than once a week	
Between one and five times a week	
Between six and ten times a week	
More than ten times a week	

How often on average do you search the literature?	
Less than once a month	
Less than once a week	
Between one and five times a week	
Between six and ten times a week	
More than ten times a week	

At work how do you currently access electronic information and how would you like to?		
	Currently access	Would like to use
Networked Computer		
Wireless Laptop		
PDA		
Mobile Phone - SMS Messenger		

TERMS AND SKILLS USED

If you search Medline (or PubMed) which of the following search facilities do you use? (Please select all that apply)	
Searching by keyword in a basic search entry box	
Using the 'related articles' or 'similar titles' facility	
Combining two concepts using AND	
Using MeSH headings	

Applying limits (English language, human subjects only, date of publication)	

The following are terms used in journal papers about EBM. Please indicate your reaction to them by ticking the appropriate box.					
	I am unaware of this term	It would not be helpful for me to understand	Do not understand but would like to	Some understanding	Yes, understand and could explain to others
Relative risk					
Absolute risk					
Systematic review					
Number need to treat					
Confidence interval					
Publication bias					

EBM RESOURCES

There are a growing number of database resources available electronically. Please indicate those which you have used or are aware of online					
(please tick for each source)	I have never heard of this	Aware of but never used	Aware of, but would like more training before using	Use occasionally	Use regularly
Bandolier (Oxford)					
TRIP Database					
Cochrane Database of Systematic Reviews					
Database of Abstracts of Reviews of Effectiveness (DARE)					
DynaMed					

InfoPOEMs and InforRetriever					
MDConsult					
Medline or PubMed					
UpToDate					

There are also a number of specialised resources available electronically. Please indicate those which you have used or are aware of online					
(please tick for each source)	I have never heard of this	Aware of but never used	Aware of, but would like more training before using	Use occasionally	Use regularly
BestBETs (Manchester)					
Clinical Evidence (BMJ)					
Drug and Therapeutics Bulletin					
Evidence Based on Call					
Health Technology Assessments					
EBM Guidelines					
NICE Guidance					
Critically Appraised Topics (CATs)					

Please rank the following in order of importance to you as an aid in clinical decision making. (Please put a '1' beside your most preferred/most used source, and a '2' beside the next most preferred/most used etc., and so on up to '5').	
Textbooks or Journals (in paper format)	
Full text electronic journals	
EBM resources listed above	
Colleagues	
Other health professionals, such as pharmacists	

VIEWS AND ATTITUTES TOWARDS EBM

	Strongly disagree	Disagree	Not sure	Agree	Strongly Agree
Practising EBM improves patient outcomes					
EBM requires critical appraisal skills to assess the quality of research					
Busy doctors do not have the time to find and critically appraise the relevant research papers					
EBM is a good concept that fails in practice					
In most areas of medicine, there is little or no evidence to guide practice					
The whole medical information "explosion" is overwhelming					

Please rank the most significant barriers to accessing health information for patient care? (Rank from 1-5, with 1 being the most significant barrier.)	
Time it takes to search	
Lack of searching skills	
Too much information that is not clinically relevant	
Lack of knowledge of resources	
Lack of easy access to electronic resources	

11 APPENDIX V: E-mail Request to Complete the Online Questionnaire

Dear

I am a second year PhD student at Loughborough University investigating the information needs of qualified doctors.

I have created an online questionnaire that takes approximately ten minutes to complete. The questions focus on Evidence Based Medicine (EBM) and electronic resources. I have gained ethical approval from the University and the questions do not relate to patients, but rather to the use of evidence and electronic resources. The questionnaire is accessible via this link - http://www.surveymonkey.com/s.asp?u=574542925136

I would really appreciate your support, as I am keen that real users at the clinical front end are involved in this research. Your support would improve the relevance and validity of the results. I appreciate the time and trouble that this work may involve and hope that you are willing and able to complete the questionnaire.

If you have any questions please do not hesitate to contact me.

Regards

Karen

K.S.Davies@lboro.ac.uk

12 APPENDIX VI: Comparison of Ely et al. (2000) General Practice Doctors and UK GPs

12.1 Diagnosis Questions

Code	Primary	Tertiary / Quaternary	Ely GP	UK GP
1.1.1.1	Diagnosis	Cause / Symptom	8.2% 115	2.2% 12
1.1.2.1	Diagnosis	Cause / Sign	4.8% 67	1.9% 10
1.1.3.1	Diagnosis	Cause / Test Finding	4.6% 64	0.2% 1
1.1.4.1	Diagnosis	Cause / Unspecified Findings	3.7% 51	0% 0
1.2.1.1	Diagnosis	Criteria	2.2% 30	2.2% 12
1.3.1.1	Diagnosis	Test / Indications	8% 112	2.4% 13
1.3.2.1	Diagnosis	Test / Accuracy	1% 14	2.6% 14
1.3.3.1	Diagnosis	Test / Timing	2.2% 31	1.5% 8
1.3.4.1	Diagnosis	Test / Preparation	0.2% 3	0% 0
1.3.5.1	Diagnosis	Test / Method	0.4% 6	0.9% 5
1.4.1.1	Diagnosis	Name finding / Body Part	0.6% 8	0% 0
1.4.2.1	Diagnosis	Name finding / Condition	0.4% 6	0% 0
1.4.3.1	Diagnosis	Name finding / Test	0.1% 2	0% 0

1.5.1.1	Diagnosis	Orientation / Condition	0.4% 5	0% 0
1.5.2.1	Diagnosis	Orientation / Test	0.1% 1	0.2% 1
1.6.1.1	Diagnosis	Inconsistencies	0.6% 8	0% 0
1.7.1.1	Diagnosis	Cost	0.1% 1	0.2% 1
1.8.1.1	Diagnosis	Not Classified Elsewhere	0.1% 1	0% 0
Total			37.6% 525	14.3% 77

12.2 Treatment Questions

Code	Primary	Tertiary / Quaternary	Ely GP	UK GP
2.1.1.1	Treatment	Drug Prescribing / How to Prescribe / Undifferentiated	0.7% 10	1.1% 6
2.1.1.2	Treatment	Drug Prescribing / How to Prescribe / Dosage	6.7% 94	2% 11
2.1.1.3	Treatment	Drug Prescribing / How to Prescribe / Timing	1.9% 27	4.1% 22
2.1.2.1	Treatment	Drug Prescribing / Drug of Choice / Treatment	10.7% 150	11.5% 62
2.1.2.2	Treatment	Drug Prescribing / Drug of Choice Prevention	2.9% 40	3.2% 17
2.1.3.1	Treatment	Drug Prescribing / Adverse Effects / Findings	4.2% 59	4.5% 24
2.1.3.2	Treatment	Drug Prescribing / Adverse Effects / Administration	0.2% 3	0.2% 1
2.1.3.3	Treatment	Drug Prescribing / Adverse Effects / Safety	1.7% 24	4.3% 23

2.1.4.1	Treatment	Drug Prescribing / Interactions	2% 28	1.7% 9
2.1.5.1	Treatment	Drug Prescribing / Name Finding	0.9% 12	0% 0
2.1.6.1	Treatment	Drug Prescribing / Orientation	1.9% 26	1.3% 7
2.1.7.1	Treatment	Drug Prescribing / Physical Characteristics	1.9% 26	0.6% 2
2.1.8.1	Treatment	Drug Prescribing / Pharmaco-Dynamics	0.1% 2	0.2% 1
2.1.9.1	Treatment	Drug Prescribing / Mechanism of Action	0.2% 3	1.1% 6
2.1.10.1	Treatment	Drug Prescribing / Cost	0.8% 11	0.2% 1
2.1.11.1	Treatment	Drug Prescribing / Serum Levels	0.1% 1	0% 0
2.1.12.1	Treatment	Drug Prescribing / Availability	0.3% 4	0.6% 3
2.2.1.1	Treatment	Not limited to but May Include Drug Prescribing / Efficacy / Treatment	5.9% 82	13% 70
2.2.1.2	Treatment	Not limited to but May Include Drug Prescribing / Efficacy / Prevention	0.1% 1	0.6% 3
2.2.2.1	Treatment	Not limited to but May Include Drug Prescribing / Timing	0.1% 2	0.6% 3
2.2.3.1	Treatment	Not limited to but May Include Drug Prescribing / How to Do It	0.1% 1	1.1% 6
2.2.4.1	Treatment	Not limited to but May Include Drug Prescribing / Principles	0.1% 1	0.4% 2
2.2.5.1	Treatment	Not limited to but May Include Drug Prescribing / Adverse Effects / Findings	0% 0	0.2% 1

2.2.5.2	Treatment	Not limited to but May Include Drug Prescribing / Adverse Effects / Safety	0% 0	1.1% 6
2.2.7.1	Treatment	Not limited to but May Include Drug Prescribing / Cost	0% 0	0.2% 1
2.3.1.1	Treatment	Not Classified Elsewhere	0.3% 4	0% 0
Total			43.8% 612	53.3% 288

12.3 Management Questions

Code	Primary	Tertiary / Quaternary	Ely GP	UK GP
3.1.1.1	Management	Condition	4.8% 67	8.9% 48
3.2.1.1	Management	Other providers / Practices of Other Providers	0.9% 12	2.6% 14
3.2.2.1	Management	Other Providers / Referral	0.6% 8	0.6% 3
3.2.3.1	Management	Other Providers / Community Services	0.4% 5	0.6% 3
3.3.1.1	Management	Doctor-Patient Communication / How to Advise	0.6% 8	1.7% 9
3.3.2.1	Management	Doctor-Patient Communication / How to Approach Difficult Issue	0.4% 5	0.4% 2
3.3.3.1	Management	Doctor-Patient Communication / Patient Compliance	1.5% 21	0.4% 2
3.3.4.1	Management	Doctor-Patient Communication / Views and attitudes	0% 0	0.2% 1
3.3.6.1	Management	Screening	0% 0	1.1% 6
3.4.1.1	Management	Not Classified Elsewhere	0% 0	0% 0

Total	9% 126	16.3% 88

12.4 Epidemiology Questions

Code	Primary	Tertiary / Quaternary	Ely GP	UK GP
4.1.1.1	Epidemiology	Prevalence	1% 14	0.9% 5
4.2.1.1	Epidemiology	Etiology / Causation / Risk Factors	2.9% 40	2.6% 14
4.2.1.2	Epidemiology	Etiology / Causation / Genetics	0.1% 2	0% 0
4.3.1.1	Epidemiology	Course	1.8% 25	1.9% 10
4.4.1.1	Epidemiology	Not classified elsewhere	0.1% 1	0% 0
Total			5.9% 82	5.4% 29

12.5 Non-Clinical Questions

Code	Primary	Tertiary / Quaternary	Ely GP	UK GP
5.1.1.1	Non Clinical	Education / Provider / CME	0.6% 8	3.3% 18
5.1.1.2	Non Clinical	Education / Provider / Information Provider	0.4% 5	1.3% 7
5.1.1.3	Non Clinical	Education / Provider / Trainee	0.1% 1	1.5% 8
5.1.2.1	Non Clinical	Education / Patient	0.2% 3	0.6% 3
5.2.1.1	Non Clinical	Administration	0.9% 13	1.5% 8

5.3.1.1	Non Clinical	Ethics	0.3% 4	0.6% 3
5.4.1.1	Non Clinical	Legal	0.1% 1	0% 0
5.5.1.1	Non Clinical	Frustration	1.1% 15	0% 0
5.6.1.1	Non Clinical	Not Classified Elsewhere	0.1% 2	0% 0
5.7.1.1	Non Clinical	Ethnicity	0% 0	0.6% 3
5.8.1.1	Non Clinical	Religion or Culture	0% 0	0.4% 2
5.9.1.1	Non Clinical	Statistics	0% 0	0.4% 2
5.10.1.1	Non Clinical	IT or Internet	0% 0	0.7% 4
Total			3.7% 52	10.7% 58

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