The University of Sydney
School of Rural Health
Office of Postgraduate Medical Education

How do prevocational trainees practice evidence-based medicine?

Final Project Report

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Commissioned by the Medical Training Review Panel

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Project Team

This project was conducted jointly by the University of Sydney's School of Rural Health and Office of Postgraduate Medical Education (OPME).
The project team is given in Table A.

Table A: Names, titles, roles, and affiliations of the project team

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Abbreviations

ACFJD	=	Australian Curriculum for Junior Doctors
CIAP	=	Clinical Information Access Program (NSW Health)
EBM	=	Evidence-based medicine
EBP	=	Evidence-based practice
HCN	=	Health Communication Network
HEU	=	High-end user
IT	=	Information technology
IWLA	=	Individual web-log analysis
LEU	=	Low-end user
PGY1 or 2	=	Postgraduate year 1 or 2

Executive Summary

There is relatively little published evidence as to how junior doctors in the first two years post-qualification are engaging with evidence-based medicine (EBM), and in particular how they are experiencing a range of tools which have been specifically designed to support the continuing development of their knowledge base and clinical reasoning skills.

This study aimed to investigate the practice of evidence-based medicine by junior doctors and particularly sought to locate understandings gained from the study within the Australian Curriculum for Junior Doctors (ACFJD), which provides national guidance on the expected level of performance of junior doctors.

The setting of this study required the year long follow-up of a selected cohort of PGY1 and PGY2 junior doctors in 2008/9 from across New South Wales.

The study focussed on an exploration of the relationships between three outcome measures of junior doctors' evidence-based medicine behaviours:

- A self-rating scale in their competence in EBM both overall and in each of the six critical stages of the EBM process,
- Observed competence as rated by a modification of a previously validated test of EBM skills (the Fresno test), and
- Web logs of information gathering activity as the junior doctors used the NSW Health Clinical Information Access Program (CIAP) during their terms.

Additionally, the study investigated the preferred teaching and learning methods for EBM, motivational factors to practice EBM, and self-confidence in using a number of recognised EBM resources. A cohort of PGY1 and 2s were recruited into the study (n=163). There were a number of key findings in the study:

- Newly graduated doctors generally rate themselves as confident in their EBM skills
- There is no strong relationship between junior doctors' self-rated competence and their actual competence at EBM
- There is an estimated 14% of junior doctors who barely use CIAP or other sources of evidence
- Nearly a fifth of junior doctors may have only limited skills in EBM as evidenced by the Mini-Fresno test scores
- The Mini-Fresno test is confirmed as a highly reliable and feasible measure of junior doctors' EBM skills; however, there is a question mark about its validity in that junior doctors' clinical needs are in pre-appraised evidence, as opposed to those aspects of EBM which are strongly epidemiologically based
- There are a number of interesting trends in the use of particular EBM resources. The principal finding is that junior doctors by and large are using pre-appraised sources of evidence; for example, Up-to-Date. It may be that critical appraisal skills using journal articles are remaining static or decreasing throughout the year.
- Many junior doctors get few opportunities in their workplace to get feedback from supervisors or colleagues to demonstrate their EBM learning
- Work-based learning seems to be the preferred method for building upon the existing skill set in EBM
- Web-log analysis is a potentially useful quality assurance and research tool; however, there are issues with the reliability of the data in this study, principally because web-logs can only be tracked if there is a personal log-in
- There is a significant use of clinical information resources around prescribing

- Advanced EBM skills are practiced by the minority, for academic reasons and usually out of work time.

There were a number of strengths to the study, in piloting a relatively innovative methodological approach. Additional qualitative data was able to unpack some of the quantitative findings. Whilst the findings are specific to junior doctors, the research methods are generalisable to a range of other healthcare professionals including trainees, specialists, general practitioners (including registrars), and within nursing.

There were a number of recognised limitations to this study. Whilst we are grateful for the cohort of around 28 doctors who fully participated in most aspects of the study, the attrition rate from the initial cohort (n = 163) was high. Whilst web-log analysis has the potential to be a powerful tool in quality assuring resource intensive tools such as CIAP, we recognise web-log activity may be a significant underestimate of the actual use of CIAP by junior doctors compared with their self-estimates of usage. This was principally due to perceived issues for the junior doctors using individualised log-ins when accessing CIAP.

A number of recommendations have been made to ensure that EBM is integrated into junior doctor supervision and training, with a particular focus on how CIAP can be enhanced to meet the particular information needs of junior doctors.

Further research might look at the impact of changes in junior doctor training, enhancing the reliability of web-log analysis, and following up junior doctors into basic and advanced training.

Recommendations

1. EBM skills are recognised as graduate attributes and the university sector needs to ensure that EBM skills are an assessable graduate attribute.

2. Universities should consider engaging with the jurisdictions to arrange for students in their pre-internship terms to have access and training in systems; for example, CIAP in New South Wales, or the Clinical Knowledge Network in Queensland.

3. Supervisors need to consider giving formative feedback on their trainees' observed performances, in clinical encounters to highlight where evidence is important for developing junior doctors' clinical reasoning skills.

4. Self-assessments of competence in the steps of EBM should be encouraged by supervisors at the time of term orientations and mid-point assessments as a means of identifying learning needs in EBM.

5. Organisers of junior doctor education and training programs need to build EBM into current best practice frameworks in work-based learning e.g. clinical reasoning sessions, teaching opportunistically around ward rounds, case based discussions or within seminars, or formal presentations.

6. Educational researchers should consider the use of the modified Fresno test (Mini-Fresno) for use in other groups of healthcare professionals as it is highly reliable and can be used conveniently as a measure of EBM skills.

7. Educational researchers need to develop a reliable instrument which has greater validity for measuring the integration of pre-appraised evidence into clinical practice and is seen as a valuable source of feedback in the context of junior doctors.

8. The web-log analysis methodology is a potentially powerful tool to measure clinical information searching activity of healthcare staff, and with appropriate modifications and safeguards should be incorporated into routine quality assurance systems by the healthcare informatics community.

9. The needs of low users of clinical information need to be investigated by the healthcare informatics community to determine user characteristics and their specific needs within CIAP.

10. In order to determine the relationship of clinical information searching with enhanced safe patient care, a technological/incentive solution for individual tracking needs to be found by the health informatics community.

11. The most appropriate sources of pre-appraised evidence need to be included within CIAP, recognizing that most junior doctors are using Up-to-Date, a source of pre-appraised evidence which is currently not contained within CIAP.

12. Educators need to work with informatics experts to ensure the CIAP system includes educational materials which support the integration of EBM learning in the workplace, particularly around pre-appraised sources of evidence. Such packages could be available online or delivered with seminars in the clinical environment.

13. Educators need to develop a framework where opportunities are provided for junior doctors to develop and receive feedback on advanced skills of critical appraisal, an exit learning outcome set by the Australian Curriculum for Junior Doctors.

14. The professional colleges need to ensure their basic training courses address the lack of progress, or even decline for most junior doctors in advanced evidence-based skills.

Conclusions

The Australian Curriculum for Junior Doctors (ACFJD) has been designed to integrate the practice of Evidence Based Medicine (EBM) into supervisory arrangements and education and training programs for junior doctors. However, there is much work to be done in developing appropriate methods and gaining traction in promoting cultural change in a busy service-driven clinical environment. Postgraduate medical educators need to come together with the health informatics community to ensure that adjustments are made to the NSW Health Clinical Information Access Program (CIAP) so that rapid access to contemporary sources of pre-appraised clinical evidence- including prescribing information- is available to junior doctors at the point of patient care. There will be a burden on supervisors to adjust to the cultural changes required by the implementation of the ACFJD, but this is now a national movement that is gaining momentum across the jurisdictions. Future research activities in this area need to be pragmatically focussed around policy and resource development as well as guiding educational and training strategies that incorporate the evidence base into junior doctors' clinical reasoning processes.

1. Introduction

Overview

Evidenced Based Medicine (EBM) is the newer paradigm of medical practice endorsed by a range of institutions concerned with the safety of patients in our heath care system and the standards to which our doctors are educated. These include the Australian Institute of Health and Welfare and the Australian Medical Council (AMC). One criteria for the assessment and accreditation of medical schools by the AMC states that graduates should possess 'the ability to interpret medical evidence in a critical and scientific manner, and to use libraries and other information resources to pursue independent inquiry relating to medical problems.' [1] The Australian Curriculum for Junior Doctors includes the practice of EBM in a curriculum that outlines the knowledge, skills and behaviours required of prevocational doctors (PGY1, PGY2 and above) in order to work safely in the Australian health care system.[2] As such, it is the pathway that all new medical graduates must follow and is the bridge between undergraduate curricula and the curricula that underpin college training programs.

One of the most consistent findings in health services research is the gap between best practice (as determined by scientific evidence) on the one hand and actual clinical care on the other.[3] Studies about the quality of care delivered to U.S. adults[4] and children[5] have found that on average, they receive about half of recommended medical care processes. Although the point estimate of the size of the quality problem may continue to be debated, the gap between what we know works and what is actually done is substantial enough to warrant attention. The articles conclude that 'these deficits pose a serious threat to the health and well-being of the U.S. public'.[4] There is no reason to assume the situation is any different in Australia.[6]

Whilst there is laudable aspiration for how interns might practice EBM and so enhance patient care, there is a paucity of evidence about how the theory of EBM translates into clinical practice.[7-9] A 2007 systematic review of the studies that had assessed the effectiveness of postgraduate teaching EBP concluded that small improvements in knowledge, skills, attitudes or behaviour are noted when measured alone. A large improvement in skills and knowledge in EBP is noted when measured together in a total test score.[10]

Whilst it is to be hoped that new graduates are competent in evidence based practice, medical students' confidence in their own EBM ability does not match their actual skills. For example, in a study of fourth year medical students in the US,[11] there was a significant gap between the perceived competence of students in practicing EBM and their actual performance according to a validated assessment instrument. It is thus essential that the intern years give graduates the opportunity to perform well in EBM skills in the interests of patient care.

Clinicians from physicians to general practitioners do not appear to routinely use the available evidence to support clinical decisions because of the various barriers that have been identified as the lack of easy access, cost of up-to-date evidence, poor searching skills and inadequate time.[12-14]

Initiatives in New South Wales

In order to address this problem there has been a major initiative within New South Wales. The Clinical Information Access Program (CIAP)[15] aims to address the access

and cost problems for hospital doctors. CIAP provides information and resources to support evidence-based practice at the point of care. CIAP contains online books, journals and a range of databases including OVID, Cochrane, MD Consult, Nursing Consult, STAT and Pubmed Central. CIAP is available to anyone in the NSW Health system - nurses, midwives, doctors, allied health, community health, administration and ancillary staff.

Previous studies that track the use of CIAP, using a method known as web-log analysis,[16] indicate that clinicians' online evidence use increases at the time of patient admissions, supporting the hypothesis that clinicians' use of evidence is related to direct patient care. The methodology used in CIAP web-log analysis research looked at associations of NSW hospital web-log accesses and hospital admissions. This study did not look at the use of CIAP by healthcare professional role, for example, doctors, nurses, allied health workers or in detail to the hierarchy of the each professional's seniority.

A 2005 survey administered to NSW hospital doctors found that that 60.4% of junior and almost half of senior doctors use CIAP close to where they treat patients, and almost one third reported using CIAP at least once a day.[17]

Work-based Learning

A second initiative, through the auspices of the Australian Curriculum for Junior Doctors,[2] is being initiated in Australia, including within the NSW Health Service with junior doctors: this is the notion of work-based learning and work-based assessment.[18] Work-based assessments include well-established assessment tools; for example, multi-source feedback and the Mini-CEX, where feedback is given by the supervisor on a short observed clinical encounter. The focus of these methods is on measuring the performance of junior doctors; that is, what they do at work with patients as opposed to measuring their competence, or what they can show they do in a classroom.

Junior doctors' perceived EBM competencies: Messages from the research

A literature review was conducted as part of this study and guided by the following research question:

What are the perceived and actual gaps in interns' EBM competencies?

The data sources were MEDLINE, ERIC and Google Scholar. We searched for studies investigating the EBM knowledge, skills, attitudes and behaviours of interns by using various combinations of the following Medical Subject Headings (MeSH) terms: evidence-based medicine, evidence based practice, information seeking, critical appraisal, intern, postgraduate year one and two, junior doctor and resident. The literature search was limited to English language publications and to the period January 1999 – present. We defined 'intern' as a doctor in his or her first or second postgraduate year and excluded all studies whose sample was not comprised at least in part by interns. We ultimately identified six studies that met our inclusion criteria.

Results and Discussion

Our search for appropriate studies for inclusion in this review revealed the following general trends:

1. Much of the existing literature on EBM knowledge, skills, attitudes and behaviours (and efforts made to improve them) focuses on residents rather than interns, with the majority citing general practitioners and emergency and internal medicine residents or consultants as participants. There is very little work that focuses specifically on interns; all studies selected counted interns among their sample but also included other types of junior doctors e.g. residents, registrars, etc (see point 2 below regarding terminology).

2. Terminology around doctor seniority is widely variable and rarely defined. In some articles 'postgraduate year' seems to refer to the number of years since a doctor has completed university training, whilst in others it refers to which year of specialist training the doctor is currently completing. The term 'intern' similarly seems to be used in different ways. Other terms such as 'resident,' 'trainee doctor,' 'junior doctor' and 'house officer/senior house officer' are used but never defined, and definitions from those articles that do define their terms cannot be extrapolated to others due to a lack of consistency across the field and between countries.

Due to widespread variation in terminology used, we will henceforth refer to the group in which we are interested ('interns' as described above) as 'junior doctors' to reflect the heterogeneous nature of the samples described in each of the studies examined in this review.

Table 1 Summary of research studies of junior doctors in the first two years of training

Author(s)	*Country*	*Year*	*EBM focus*	*Participants*	*Methods*
Bazarian JJ, Davis CO, Spillane LL et al[19]	USA	1999	knowledge and skills	32 emergency medicine residents (16 interns/EMR-1s and 16 second-year residents/EMR-2s	Controlled trial (16 in each group)- pre-test and post-test article review + questionnaire on previous experience and training and journal reading habits
Forrest M and Robb M[20]	UK	2000	attitudes and behaviours	152 doctors-in-training (specialist registrars, GP trainees, house officers, senior house officers)	Interviews with consultants and administrators; focus group with library staff; self-rated questionnaire for doctors-in-training (accessibility, frequency of use, ease of access of various information sources; activities resulting in information needs; future information needs)
Oliveri RS, Gluud C and Wille-Jorgensen PA[21]	Denmark	2004	knowledge, skills, behaviours	225 hospital doctors varying in specialty and charge (registrar, specialist registrar, staff specialist and consultant)	Self-rated questionnaire survey (knowledge of methodological terms, frequency of use of information sources, competence in critical appraisal, frequency of EBP)

Westbrook JI, Gosling AS and Westbrook MT[17]	Australia	2004	skills, attitudes, behaviours	1076 junior and senior doctors (392 junior medical staff- interns, junior and senior resident medical officers, registrars; 684 senior medical staff- staff specialists, consulting/visiting medical officers)	Self-rated questionnaire survey (awareness and use of CIAP; reasons for CIAP use/non-use; access location and frequency; ease and effectiveness of use, databases and journals accessed)
Shirkhedkar P and Day AS[22]	Australia	2008	knowledge, skills, attitudes, behaviours	106 paediatric junior medical officers (JMOs)- definition provided	Self-rated questionnaire (accessibility, frequency of use and preferences for electronic information resources; perceived adequacy of training and expertise in online searching)
Ahmadi-Abhari S, Soltani A and Hosseinpanah F[23]	Iran	2008	knowledge and attitudes	104 trainee doctors, which include interns, residents and subspecialty fellows of internal medicine (69 interns, 35 postgrads)	Self-rated questionnaire survey (evaluation of EBM knowledge; attitudes towards EBM; frequency of use of various information resources)

All six studies reviewed employed self-assessment questionnaires as a means of data collection. One also used a pre- and post-test critical appraisal exercise to ascertain any changes in participant EBM skills.[19] Another study examining the information needs of doctors-in-training took a multimodal methodological approach that involved individual interviews with consultants and administrators, a focus group with library staff, and a self-assessment questionnaire for doctors-in-training themselves.[20] Individual interviews were conducted with a number of questionnaire respondents in order to validate findings and provide more in-depth commentary on issues highlighted.

Junior doctors have positive attitudes towards EBM, but they appear to lack some basic EBM knowledge and need up skilling in literature searching.

Junior doctors are increasingly becoming exposed to EBM starting early in their university-based medical training, which may contribute to the positive attitudes they demonstrate towards EBM.[19,23] Junior doctors rate their own computer skills significantly higher than senior doctors, and are more likely to know about and use resources such as New South Wales (NSW) Health's Clinical Information Access Program (CIAP).[17] They also rate CIAP easier to use than do senior doctors and use it near the point-of-care more often.[17] Junior doctors' patterns of usage, online experiences and attitudes towards CIAP, however, are relatively similar to those of senior doctors.[17]

In terms of literature searching skills, junior doctors appear to need more practice and training. One study that examined the medical literature search practice of paediatric junior medical officers (JMOs) found that the vast majority (over 90%) felt they needed further training in this area.[22] This was regardless of amount or duration of any previous training in online medical literature searching, with more than half of doctors with prior training reporting it as having been inadequate. Infrequent searching (i.e. lack of practice) was also reported to be a problem in that it contributed to deskilling.[22]

Junior doctors also seem to lack basic EBM knowledge. One study focusing on the EBM knowledge and attitudes of trainee physicians found that the majority of interns lack adequate knowledge about the basic concepts of EBM, such as sensitivity, specificity and understanding levels of evidence.[23] While it is important to note that, unlike Australian-trained interns, interns in this study had not received any prior EBM education, similar results in terms of a lack of basic EBM knowledge have been found in other studies done in countries around the world.[23] Oliveri, Gluud and Wille-Jorgensen's[21] study of hospital doctors' self-rated EBM skills and use, for example, concluded that most doctors seem to lack knowledge of key methodological EBM terms, and Shirkhedkar and Day[22] found that their entire cohort of paediatric JMOs used MeSH terminology infrequently, had a poor understanding of basic software features such as the correct use of Boolean operators and poor understanding of the two most commonly used interfaces for Medline (OVID and PUBMED).

Junior doctors may be overly reliant on colleagues, textbooks and Medline as information sources.

The evidence overwhelmingly suggests that interns are relying on traditional and perhaps inadequate sources when seeking information. Oliveri, Gluud and Wille-Jorgensen[21] found that the younger doctors in their sample most frequently sought information from senior colleagues, a finding mirrored in the results of half the studies examined in this review.[20,23] Junior doctors in the UK identified 'colleagues and consultants' from a list of 34 possible sources as the most popular source of information in terms of accessibility and frequency of use.[20] Textbooks also figured prominently as an information source.[20,21,23]

In terms of electronic sources, Medline was the most frequently consulted resource for junior doctors.[17,20,22] Shirkhedkar and Day[22] found that Medline was the first or second choice of resource for 74.5% of participants. Few junior doctors seem to be relying on synthesized resources such as the Cochrane Library, widely accepted to be among the gold standard of EBM resources.[21-23] There may be a need to promote other databases to junior doctors and educate them appropriately in their use, as Medline is not comprehensive nor the best source of information for answering all types of questions.[20]

Barriers to EBM practice

The main issues raised by participants in the studies reviewed were limited access to information sources (including a lack of availability of full-text journals and articles) and lack of time to find and obtain information. New South Wales has made great strides in addressing the first problem with the advent of the Clinical Information Access Program (CIAP), providing access to evidence-based resources at the point-of-care to all health care professionals working in the NSW Health system. The issue of lack of time to find and obtain information may at least in part be addressed by educational interventions designed to address gaps in EBM knowledge and skills as identified above; for example, ensuring junior doctors understand basic EBM terminology concepts and are upskilled in the area of electronic database searching would likely streamline and minimize the time required for EBM practice.

Educating junior doctors in EBM

Some suggestions for developing appropriate educational interventions that target above-identified gaps in junior doctors EBM competencies include face-to-face courses on online search skills and statistical analysis, library tip sheets on how to search online

literature effectively and which resources to use when/for which questions, and journal clubs that use an EBM approach to critical appraisal.[20,22] Face-to-face courses may be best attended if held either before or after hours; breakfast sessions have been found to be popular in one hospital library.[20] While this review did not explicitly focus on appraising the literature on EBM educational interventions, it appears difficult to draw any conclusions regarding existing interventions' ability to improve knowledge, skills, attitudes or behaviour, as much of what has been reported is of poor quality and design.[24] It may be prudent, however, to consider introducing competency tests with high reliability and validity in assessing knowledge and skill in all the usual domains of EBM (e.g. the Fresno[25]) as formative assessment into all training programs, as they have been identified as the best way of showing improvement in evidence-based practice skills.[24]

Conclusions

There is little reported research on EBM competencies of junior doctors as a specific group, and terminology used is often variable and poorly defined. Junior doctors have positive attitudes towards EBM, but they appear to lack some basic EBM knowledge and require upskilling in literature searching. They are also overly reliant on colleagues, textbooks and Medline as information sources. The research evidence suggests that education should focus on refresher courses on EBM basics and the promotion and utility of more comprehensive and reliable information sources (such as the Cochrane Library).

Project Aims and Objectives

Our project aims to address the gaps in our knowledge of how junior doctors in the first two years post-graduation are using the Clinical Information Access Program, to what standards our interns practice EBM, and to indicate interns' future training needs whose objectives were to improve knowledge, critical appraisal skills, attitudes and behaviours of postgraduate healthcare workers. We also examined the measures used to evaluate the effectiveness of the intervention, together with their reliability and validity.

The study objectives were to:

1. Assess any associations between EBM performance and internship appointment, location, rurality of the internship hospital, medical school, time from graduation and other demographic factors.

2. Evaluate the perceived EBM competence as perceived by interns using a self-assessment questionnaire.

3. Determine the trends of web access of CIAP EBM resources by interns using web-log analysis (WLA).

4. Evaluate the EBM competence of interns using a validated web-based knowledge and skills test (Fresno Test).

5. Determine the associations between the Fresno scores, WLA and self-assessment questionnaire scores.

6. To bring together evidence from existing literature and from the experiences of project team and stakeholders to produce a preliminary analysis of the perceived competencies and training needs of interns for EBM.

7. Make recommendations on strategies for the enhancement of EBM in PGY1 and 2 to relevant bodies.

2. Methods

Setting

This study took place in New South Wales. The population of interest was all PGY1 and PGY2 doctors working in NSW hospitals in 2008. The study focussed on investigating a sample of this cohort's use of the NSW Clinical Information Access program (CIAP), relating this to their practice of EBM and determining their subsequent training needs.

CIAP is available to clinicians in public hospitals across NSW and also to rural general practitioners. It consists of:

a) OVID databases: bibliographic resources such as MEDLINE, EMBASE and OVID journals, and
b) Non-OVID databases: other knowledge resources such as Therapeutic Guidelines (eTG), MIMS, Australian Handbook of Medicine and the Cochrane library.

At the time of this report's publication CIAP does not include resources such as Up-to-Date.

The Health Communication Network (HCN) is the vendor organization that provides the technological services and support required to run and maintain CIAP.

Each hospital has its own CIAP username and password (log-in) used by all staff at that hospital. In many hospitals, computers are permanently logged on. For this study, however, we worked in collaboration with CIAP and HCN to obtain individual usernames and passwords (individualised log-ins) for our participants. This allowed us to track their use of CIAP resources.

Study Design

This was a cohort study over one year. We were interested to know junior doctors' perceptions of their EBM skills and compare the change in these over time in a pre-post analysis. We correlated their perceived EBM skills with their observed skills using an EBM skills test (the Mini-Fresno) and their use of clinical information using the web-log analysis data as a proxy measure. We collected descriptive data on training needs.

Outcome Measures

We collected data on junior doctors' EBM skills, attitudes and behaviours using the following outcome measures:

Table 2 Outcome measures

Data collection method	*Timing (over 12 month study period)*
a) two self-assessment questionnaires (SAQ1 and SAQ2)	SAQ1 upon study registration; SAQ2 near the end of the study period (approximately 11 months post-registration)
b) individual web-log analysis: tracking of individual junior doctor access of NSW Health's Clinical Information Access Program (CIAP)	Monthly
c) Mini-Fresno- a modified version of the Fresno,[25] a validated EBM competency test	Midpoint of study (approximately month 6)
d) qualitative interviews conducted by telephone	Near the end of the study period (approximately months 10 and 11)

Ethics Approval

Ethical approval for the study was granted by the University of Sydney Human Research Ethics Committee (Ref No 12-2007/10535) and the NSW Population and Health Services Research Ethics Committee (Cancer Institute NSW Reference No 2007/12/049).

Recruitment and Sampling

Information provision (Phase I)

The NSW Institute for Medical Education and Training (IMET) posted informational letters regarding the project out to all PGY1 and PGY2 doctors in NSW in the first week of January, followed by a reminder email in the second week. A brief project description and link to the project website was also placed on the IMET website. Emails were sent out to all NSW hospital librarians informing them of the project and seeking their support. Information about the study was also made available via the CIAP main page.

Active recruitment (Phase II)

The active recruitment phase took place from January – March 2008. With IMET's support and hospital contact information channels (JMO Administration within the Prevocational Training Networks), we scheduled and gave brief presentations to junior doctors in 11 different NSW hospitals (others failed to respond despite repeated attempts at contact via phone and email). Presentations were delivered either immediately before or after a scheduled education session and provided background information to the study and an overview of what participation would involve. Copies of the participant information statement and the first self-assessment questionnaire (SAQ1) were circulated to all attendees, who were provided with sufficient time to read through these materials and opportunity to ask any questions. Doctors indicated their interest in participating in the study by choosing to complete the SAQ1 and returning it to the presenter (completion of SAQ1 served as study registration, as it also collected demographic information). Doctors were also informed that they could register (complete the SAQ1) online instead. The SAQ1 collected identifying information so that participants could be contacted with details on how to complete other study tasks; participants were informed of this. Information

flyers were also left with the hospital libraries and JMO Managers at presentation sites to be provided to any junior doctor that was not able to attend the presentation.

We also individually contacted all JMO Managers and Resident Medical Officer Association presidents in each hospital to seek their assistance with recruitment via circulation of an email to relevant staff/members about the project containing information on how to register online.

Registration for PGY1s closed on 15 February 2008 due to the excellent response. Registration remained open for PGY2s until 21 March 2008 due to challenges in recruiting that particular group, a phenomenon that appeared to be largely due to the lack of opportunities for on-site presentations as compared to those available for PGY1s (on-site presentations were by far the most successful recruitment strategy employed; letter and email communications resulted in less than 10% of registrations).

The final sample consisted of 127 PGY1s and 36 PGY2s for a total of 163 participants.

Self-assessment questionnaire 1 (SAQ1)

The purpose of the SAQ1 was to collect demographic information, to ascertain junior doctors' perceived EBM competencies, preferred learning methods and confidence in using various EBM resources and databases, and to ascertain the factors junior doctors feel facilitate and impede their practice of EBM (see Appendix A for the complete questionnaire). The questionnaire also served as study registration.

Development

No previously published or validated questionnaires that fit with project objectives could be located; thus, we developed SAQ1 based on the following:

A) mapping the learning objectives and content of a typical medical school's EBM curriculum and the requirements of competency within the Australian Junior Doctor Framework

B) the practical needs and concerns of intern doctors as observed when the questionnaire was pilot-tested with USyd Year 4 students and subsequently refined, based on written and verbal feedback obtained.

Administration

The questionnaire was administered both in print (at face-to-face presentations made at various hospitals during the active recruitment phase) and online (distributed to members of the study population via email) at the beginning of the study.

Individual web-log analysis

The Clinical Information Access Program (CIAP) is able to produce logs of the use of its OVID databases such as MEDLINE, EMBASE, Cochrane Reviews and OVID journals. Use of these indicates the higher EBM skills of critical appraisal. Data from and Non-OVID sources are particularly used in prescribing such as MIMs, Australian Handbook of Medicine and MicroMedex. Only a few resources such as the electronic Therapeutic

Guidelines (eTG) are in non-OVID resource category that generally indicates the use of pre-appraised evidence.

The study participants were provided with individual usernames and passwords for accessing CIAP (individualised log-ins) such that we could track their use of CIAP resources.

Tracking of CIAP resources is done by two methods. The non-OVID sources are tracked by 'hits,' which refers to 'pages accessed'. The OVID resources are tracked by 'sessions,' which refers to 'frequency of access and duration'. If a user does two searches after logging in to an OVID resource, this is recorded as a single session and the duration will also be recorded.

Individual utilisation of CIAP resources has not been reported in any specific group of health professionals in NSW. Previous reports of CIAP access pertained to a mixture of clinicians, including doctors, nurses and allied health personnel. They did not differentiate between groups as there has never previously been the opportunity to assign individualised log-in details. Our report of intern doctors for a period of one year is thus unique.

Administration

Soon after registration (completion of SAQ1), participants were sent their individual CIAP username and password via email, along with information on what to do in case of technical difficulties. Participants were randomly assigned to usernames that all took the form of *ebm###* (e.g. ebm001, ebm002, etc), and due to limitations of CIAP's infrastructure passwords were set as *usyd123* by default. Participants were each instructed to email HCN to change their password to something unique and memorable for them.

Follow-up emails were sent out to each participant approximately two weeks after registration to help guard against lost/missed/junked original emails, to remind participants to log-on every time they used CIAP, and to remind them to change their passwords. This practice was repeated several times throughout the course of the study in the interest of maintaining response rates.

Participants logged on to CIAP using their individual log-in details in much the same way they would if they were entering their hospital's log-in details; the only difference was they were required to do so via a brightly coloured study log-in button prominently positioned on the CIAP homepage. When participants logged in to CIAP via this button, their usage of the program was automatically tracked by HCN, who relayed the details of participant access to the research team via monthly reports.

Self-assessment questionnaire 2 (SAQ2)

The SAQ2 was delivered in approximately the 11th month of the study. It included many of the same questions asked in the SAQ1 to determine any changes using matched pairs of data, including junior doctors' perceived EBM competencies, confidence in using various EBM resources and databases, and factors junior doctors feel facilitate and impede their practice of EBM (see Appendix B for the complete questionnaire). The SAQ2 also explored in greater depth participant usage frequency of various EBM resources (including CIAP) for the purpose of triangulation with data obtained in the CIAP web-logs.

As noted above, the SAQ2 included many of the same questions as SAQ1. The additional questions around frequency of use with respect to CIAP and other resources were developed by a member of the project team and circulated via email to other team members for review and revision before being drafted in their final form. The SAQ2 was adapted for online delivery and administered via an initial and several reminder emails to participants.

Mini-Fresnos

The purpose of the Mini-Fresno assessment was to ascertain the observed EBM competence of junior doctors.

Development

The Fresno[25] is a validated instrument that assesses multiple EBM domains via a total of 12 different questions asked in relation to two different case studies. Each question has its own marking rubric. The Fresno is specified to require 30 - 45 minutes for completion.

After extensive consultation between members of the project team, it was determined that the original Fresno needed to be modified for the purposes of our study. The resulting 'Mini-Fresno' consisted of seven of the 12 questions characterizing the original Fresno, and required response to these questions for just one case instead of two (See Appendix C). This was decided for reasons of both relevance to the project aims and logistics in terms of minimizing attrition due to overburdening of participants. We also decided to develop our own cases for use with the Mini-Fresno questions to ensure relevancy of content to our junior doctor audience (the original Fresno is aimed at more senior clinicians in the specialty of Family Medicine). Four new cases for use with the Mini-Fresno were developed by the project team and validated internally after multiple revisions. The marking rubrics for each of the seven Mini-Fresno questions were also subjected to this revision/validation process for each of the four new cases, though changes to these rubrics were kept minimal in the interest of remaining as true to the original Fresno as possible.

There were thus two versions of the mini-Fresno for use in this study: Stream A consisting of cases 1 and 3; Stream B of cases 2 and 4. The Stream A and Stream B Mini-Fresnos were adapted to a web-based format and piloted with a total of five Year 3 and 4 students from School of Rural Health, University of Sydney and Northern Clinical School, University of Sydney. Results indicated the two Mini-Fresnos posed no usability or functionality problems, with all five students successfully completing the exercise and with responses anticipated by the associated marking rubrics (See Appendix D).

Administration

The Stream A and Stream B mini-Fresnos were administered to participants via email. Participants were randomly assigned to either Stream A or Stream B when they clicked on the link provided in the email. As noted above, they were only required to answer questions for one of the two cases (not both) associated with the Mini-Fresno. Participants were permitted to select the case of their choosing.

Qualitative Interviews

Qualitative interviews were not a part of our original research methodology. The project team included them for the purpose of validating the data collected from the web-log analysis.

Development

Based on the project data from the web-log analysis, we opted for two streams of interviews: one for the low-end user (LEU) participants (those identified as rarely or never having used their individual CIAP log-in details over the course of the study due to no IWLA data being reported) to inquire about the reasons behind their non-use and what EBM sources they turned to instead, and one for the high-end user (HEU) participants (those identified as having regularly used their individual CIAP log-in details as evidenced by regular IWLA data being reported) to gain more information regarding their EBM practice and CIAP access habits. Semi-structured interview schedules were developed for each stream by one member of the project team and circulated via email to other team members for review and revision before being drafted in their final form (Appendices E and F).

Administration

A total of 132 participants were identified to be LEUs; the remaining 31 were considered to be HEUs. All participants from both groups (streams) were contacted for an interview; three attempts were made before deeming a participant non-responsive. Five- to ten-minute telephone interviews were conducted by two members of the project team with 60 LEUs (45.5%) and 11 HEUs (35.5%). Interviews were audio-recorded with participant consent and later transcribed and analysed using Framework Analysis.[26]

Data management

All data was collected according to standard university research protocols via processes approved by the University of Sydney's Human Research Ethics Committee. The following strategies were put in place for the purposes of risk management and maintaining confidentiality:

- all potential participants were provided with an information statement containing details regarding the purpose of the project, what participation would involve in terms of activities and time commitments, assurance of privacy and confidentiality, the option of refusal to participate and details regarding how to make a complaint or withdraw from the study should they wish to do so
- hard copy data was stored in secure filing cabinets in a locked office accessible only by the project manager
- electronic data was stored on secure University of Sydney server accessible only by individual researcher log-in
- upon study registration, participants were provided with a codename (*ebm###*) that they used throughout the course of the study for all data collection activities; the code list was only accessible to the project manager
- all data was reported in a de-identified manner
- telephone interviews were transcribed using only participant codenames

Data Analysis

Data was accessed from the combined database containing the survey data, assessment results, web-log summaries and de-identified junior doctor demographic variables. All analysis was conducted in SPSS Version 16.0 (SPSS Inc., Chicago, IL, USA). A power calculation showed that to have an 80% chance of significance in the pre-post analysis with a moderate difference we needed to have 62 cases in the initial cohort and 16 cases in the second group.

Self-assessment questionnaires

The pre-test knowledge EBM self-rating test (SAQ1) was completed by all participating junior doctors as part of the initial survey. Reliability (internal consistency) of the EBM self rating used Cronbach's alpha. Standard descriptives such as means and standard deviations were reported.

Total confidence score of the EBM steps was taken as the mean of all the six different EBM score totals. Global confidence score was recorded as a separate variable, as was global IT skills and global clinical skills.

Non-Parametric tests were used to investigate wether there had been any significant change in a number of paired variables. In the Wilcoxon test, ranks are based on the absolute value of the difference between the two test variables. The sign of the difference is used to classify cases into one of three groups: differences below 0 (negative ranks), above 0 (positive rank), or equal to 0 (ties). Tied cases are ignored. Z is a standardized measure of the distance between the rank sum of the negative group and its expected value. The two-tailed asymptotic significance estimates the probability of obtaining a Z statistic that is as extreme or more extreme in absolute value as the one displayed, if there truly is no difference between the group ranks.

Mini-Fresno

The overall internal consistency of the questionnaire was measured with Cronbach's alpha. Relationships between the Mini-Fresno and other variables of interest were explored using Pearson’s coefficient.

Individual web-logs

The web-log analysis was done using two methods. The non-OVID sources are tracked by ‘hits,’ which refers to ‘pages accessed’. The OVID resources are tracked by ‘sessions,’ which refers to ‘frequency of access and duration’. If a user does two searches after logging in to an OVID resource, this is recorded as a single session and the duration will also be recorded. All statistics were presented as frequency counts.

Qualitative interviews

This used Framework Analysis which is explained in more detail in the next section of this report.

3. Results

The results are reported under each of the section headings that relate to the study objectives.

A cohort of 163 JMOs was recruited initially into the study (127 PGY1s and 36 PGY2s).

The attrition rate for the web-log and Mini-Fresno aspects of the study was high but a reasonably stable cohort of 28 junior doctors (HEUs) progressed throughout the study, providing detailed quantitative data. In determining whether this subset was a representative sample of the initial cohort, we note there was no significant difference between the cohorts (HEUs and LEUs) in terms of gender (Chi squared, p = 0.12).

Associations between intern demographics and EBM performance (Study Objective 1)

Of the initial cohort who completed the SAQ1, 89% (n=145) received their primary degree in Australia (see Table 3.1). Forty-four percent were from the University of Sydney, and 30.7% were from the University of New South Wales. There was some representation from across the states and territories. 56% were female and 45% were male. Eighty percent were PGY1, the rest being PGY2.

Table 3.1 Initial cohort by international and local awarding of medical degrees (N = 163)

University	*Frequency*	*Percent*
USyd	71	43.6
UNSW	50	30.7
Overseas	18	11.0
Newcastle	11	6.7
Flinders	4	2.5
UTas	3	1.8
ANU	2	1.2
Melbourne	1	.6
Monash	1	.6
UQ	1	.6
UWA	1	.6
Total	163	100.0

There was a broad range of representation from metropolitan, outer, metropolitan and rural hospitals (Table 3.2). Over three quarters (76%) had a metro placement in their first term. Nearly 80% had English as their first language. Eighty-two percent were aged 30 or under.

Table 3.2 Distribution of initial cohort from across NSW hospitals (N =163)

Hospital	*Frequency*	*Percent*
Royal North Shore	25	15.3
Royal Prince Alfred	25	15.3
Concord	22	13.5
Liverpool	20	12.3
Gosford	13	8.0
Nepean	9	5.5
Bankstown	7	4.3
Hornsby	6	3.7
St Vincent's	5	3.1
Manly	4	2.5
Prince of Wales	3	1.8
St George	3	1.8
Wagga Wagga	3	1.8
John Hunter	2	1.2
Tamworth	2	1.2
Canberra Hospital	2	1.2
Westmead	2	1.2
Wollongong	2	1.2
Wyong	2	1.2
Auburn	1	.6
Balmain	1	.6
James Fletcher	1	.6
Lismore	1	.6
Mater Misericordiae	1	.6
Sutherland	1	.6
Total	163	100.0

Difference in perceived EBM skills between USyd and UNSW

The majority of the junior doctors in the initial cohort were from either UNSW or USyd; therefore, it was possible to estimate differences in overall self rated EBM competence, IT and clinical skills between graduates of the different universities. There was a significant difference between USyd and UNSW, favouring USyd in overall self-rated competence in EBM skills (Mann Whitney U=106.5, $p< 0.001$). Looking at this in more detail, the significant differences in favour of EBM were held right across the steps of the EBM process apart from changing practice in the light of evidence (Mann Whitney U =1657, p=0.50) (See Appendix A for SAQ questions).

Interns' perceived EBM competence (Study Objective 2)

Self confidence in the steps of EBM

The reasoning process in EBM comprises of several key steps; thus, the junior doctors were asked in the SAQ1 to rate their self confidence in each of the steps, from Step 1 "converting a clinical problem into a question" through to Step 6 which is "evaluating the impact of evidence based clinical decision." The Likert scale used ranged from 0 (poor) to 4 (excellent). The internal consistency of the scale was high for the SAQ1 (r = 0.81, Cronbach's alpha) and for the SAQ2, r = 0.79.

It can be seen from Table 3.3 that the JMOs' initial highest confidence was for "converting information into a clinical question" (mean, 2.10 ± 0.81). It was only fair at "integrating "information into knowledge" and "changing practice in light of this new knowledge." Confidence was also less strong on "critically appraising the evidence" (1.72 ± .91).

The calculated total EBM confidence score of all the steps (11.11 ± 3.95 and 11.32 ± 3.486) remained almost the same on the post-questionnaire (SAQ2).

There was no significant differences in the self rated EBM confidence scores calculated with Wilcoxon Sign Ranks Tests for any of the steps in the EBM process. The z score and confidence levels can be seen in the last column of Table 3.3.

Table 3.3 Confidence in evidence based practice steps

Steps of evidence based practice	*SEQ-1 N=163*	*SEQ-2 N = 28*	*Difference between SEQ-1 & SEQ-2*
	*Mean ± SD Scale**	*Mean ± SD Scale**	*Wilcoxon Sign Ranks Test Z score, Sig*
1. Converting a clinical problem into question	2.10 ± 0.81	2.07 ± .86	-.58, 0.564
2. Tracking down best evidence	1.88 ± 0.85	1.82 ± .82	-.69, 0.491
3. Critically appraising evidence	1.72 ± 0.91	1.68 ± .82	-.26, 0.796
4. Integrating info with what you know	1.94 ± 0.83	2.00 ± .82	.000, 1.00
5. Changing practice in light of evidence	1.91 ± 0.82	2.11 ± .88	.000, 1.00
6. Evaluating performance of decision	1.55 ± 0.80	1.64 ± .78	-1.057, 0.29
Total confidence in all EBM steps	11.11 ± 3.59	11.32 ± 3.49	-.316, .752

Scale 0 = poor, 1 = fair, 2 = good, 3 = very good, 4 = excellent*

Resources used by JMOs during the internship

We asked what junior doctors were using as their main resource to support their clinical work. Table 3.4 shows that they used their colleagues and peers at least once day as the main source of information (1.00 ± 1.52), closely followed by CIAP (1.18 ± 1.54). Print sources such as text books and journals and other web portals were used only about once a week, and Cochrane and other web-based medical portals even less frequently.

Table 3.4 Resources used by junior doctors during internship for SAQ-2 (N=28)

Resource	*Mean ± SD Scale**
Colleagues / peers (Fellow interns, registrars, consultants)	1.00 ± 1.52
CIAP (Total usage- whether you used your log-on details or not)	1.18 ± 1.54
General search engines (Google, Google Scholar, Scirus)	2.00 ± 1.54
Other internet/web-based portals (Cochrane, eMedicine, Medscape)	3.07 ± 1.61
Print/paper resources (e.g. textbooks, journals)	3.14 ± 1.61

*Scale **
0 = more than once a day
1 = once a day
2 = 2-5 times a week
3 = once a week
4 = 1-3 times a month
5 = less than once a month
6 = never

How many doctors used their individual CIAP log-in details

The doctors who were in the HEU group (those who participated regularly in the web-log part of the study) were asked to estimate the proportion of time that they used their individualised log-in details when they logged into CIAP. Table 3.5 shows that although these junior doctors accessed CIAP about once a day, only 14% of the cohort was using their individualised log-in details most of the time; however, over half were using their individualised log-in at least 50% of the time.

Table 3.5 Frequency of use of individual CIAP log-in details

Frequency of CIAP access	*SAQ 2 N = 28*	
	N	*Percentage*
0 = 90-100% of the time	4	14.3
1 = more than 75% of the time	2	7.1
2 = more than 50% of the time	6	21.4
3 = more than 25% of the time	2	7.1
4 = less than 25% of the time	9	32.1
5 = never	5	17.9

Competence in using EBM databases and search engines

The junior doctors were asked to estimate their competency at using a range of databases and search engines that were associated with the practice of EBM. Table 3.6 shows the junior doctors are most competent at using Google (3.28 ± 1.31), with eTG (3.04 ± 1.60), and Up-to-Date (2.94 ± 1.80) close behind. In searching they were more competent using Ovid Medline (2. 86 ± 1.21) than Google Scholar (1.56 ± 1.74).

It seems that there has been a decrease in self-assessed competence in PubMed searching, Ovid Medline, Cochrane, Google and Google Scholar; however, the self-assessed competence in pre-appraised evidence resources such as eTG, BMJ clinical evidence and Up-to-Date seems to have increased.

The only significant difference between the pre- and post- test scores was for Cochrane Library (which showed a decrease) and eTG (showed an increase). This evidence supporting the reduction in advanced EBM practice and a move towards using pre-appraised evidence is taken up in the discussion.

Table 3.6 Competence in using EBM resources and search engines

EBM resources and search engines	*SAQ-1 N=163*	*SAQ-2 N = 28*	*Difference between SAQ1 & SAQ2*
	*Mean ± SD Scale**	*Mean ± SD Scale**	*Wilcoxon Sign Ranks Test Z static, Asymp. Sig*
Google	3.28 ± 1.31	3.11 ± 1.13	-1.04, 0.300
eTG	3.04 ± 1.60	3.68 ± 1.09	-2.44, 0.02
OvidMedline	2.86 ± 1.21	2.54 ± 1.40	-1.67, 0.09
Cochrane Library	2.49 ± 1.24	1.93 ± 1.25	-2.01, 0.04
PubMed	1.96 ± 1.31	1.86 ± 1.56	-1.72, .099
BMJ Clinical evidence	1.81 ± 1.58	1.96 ± 1.60	-.49, 0.62
Google Scholar	1.56 ± 1.74	1.54 ± 1.71	-.64, 0.52
Scirus	0.27 ± 0.78	0.25 ± 0.84	-.18, 0.85
BestBets	0.27 ± 0.68	0.33 ± 0.88	-1.41, 0.16
DynaMed	0.25 ± 0.65	0.36 ± 0.95	-.96, 0.34

Scale 0 = Poor, 1 = Fair, 2 = Good, 3 = Very Good, 4 = Excellent*

Preferred learning methods

Junior doctors were asked about a number of instructional methods for continuing their learning of EBM. They preferred learning about EBM 'whilst working on the job' (mean =1.55). They also liked seminars (1.38). The least preferred learning method was lectures (1.06) or books (0.91). This finding should be noted with the observation (Table 3.4) that they were only consulting books about once a week anyway.

Table 3.7 Preferred learning methods

	Mean	*Median*	*Std. Deviation*
Work-Based	1.55	2.00	0.66
Seminars	1.38	1.00	0.71
Online courses	1.27	1.00	0.82
Internet	1.26	1.00	0.75
Lectures	1.06	1.00	0.75
Books	0.91	1.00	0.79

Scale 0 = Least preferred, 1 = Some what preferred, 2 = Most preferred, 3 = Unable to evaluate*

Motivation to practice EBM

The factors that motivated the junior doctors to practice EBM were the presence of free internet access (3.53 ± .78), improving their clinical expertise (3.27 ± .778), and internet access on the wards (3.25± .88). The least important factor motivating EBM practice was how they were taught EBM at medical school. Even this lower figure of 2.63 ± 1.149 declined to 2.29 ± 1.182 towards the end of the year. There were no significant changes in any of these factors between the pre- and post- questionnaire.

Table 3.8 Motivation to practice EBM

Factors	*SAQ-1 N=163*	*SAQ-2 N = 28*	*Wilcoxon P*
	*Mean ± SD Scale**	*Mean ± SD Scale**	
Having free access to preferred resources	3.53 ± .780	3.54 ± .673	0.21
Desire to improve my clinical expertise	3.27 ± .778	3.04 ± .744	0.07
Having internet access on wards	3.25 ± .883	3.43 ± .742	0.21
Having clinical supervisor who practices EBM	3.04 ± 1.012	2.75 ± 1.076	0.08
Way I was taught EBM in med school	2.63 ± 1.149	2.29 ± 1.182.	0.29

Scale 0 = no influence, 1 = a little influence, 2 = moderate influence, 3 = a lot of influence, 4 = very high influence, 5 = unable to evaluate*

Factors that limit the practice of EBM

Lack of adequate time (2.10 ± .750) and not having free access to preferred resources are the factors that limit the practice of EBM (Table 3.9). The level of junior doctors' IT skills (0.64 ± .89), attitude of the supervisor towards EBM (1.15 ± 1.19) and their own competence/skills in EBM (1.25 ± 0.85) are not limiting factors. There were no significant differences in comparing the SAQ1 and 2 using Wilcoxon matched pairs.

Table 3.9 Factors that limit the practice of EBM

Factors	*SAQ-1 N=163*	*SAQ-2 N = 2*
	*Mean ± SD Scale**	*Mean ± SD Scale**
Lack of adequate time	2.10 ± .75	2.19 ± .68
Not having free access to preferred resources	1.57 ± 1.05	1.85 ± .86
Lack of internet access on wards	1.46 ± .1.04	1.89 ± .93
My own competence / skill in EBM	1.25 ± .85	1.26 ± .86
Attitude of my supervisor towards EBM	1.15 ± .1.19	1.26 ± 1.23
Level of my IT skills	0.64 ± .89	0.74 ± 1.13

Scale 0 = does not / rarely limits, 1 = somewhat limits, 2 = often limits, 3 = always limits, 4 = unable to evaluate*

Global competence with information technology (IT) and EBM

Overall junior doctors rated themselves (see Table 3.10) as competent or less in both clinical skills (mean = 1.86) and EBM (1.80) but competent or above in their IT skills (2.29). It is perhaps interesting that their perception of competence in their IT skills was less than their perception of competence in their clinical skills.

Table 3.10 Overall self ratings of competencies in IT, clinical skills and the practice of EBM

Factor	*Mean*	*Median*	*Std. Deviation*
IT	2.29	2.00	0.79
Clinical Skills	1.86	2.00	0.54
EBM	1.80	2.00	0.58

0 = unable to perform, 1 = limited competence, 2 = competent, 3 = highly competent, 4 = expert and can teach

CIAP EBM resource access trends (Study Objective 3)

Data of the web-log activity of those junior doctors using their individualised log-in for the study period was collected from HCN. Data was collected for OVID sources and separately for Non-OVID sources.

Non-OVID data

The data presented in this section represents the complete non-OVID data set for the study from February 2008 to January 2009.

Out of the original cohort of 163 junior doctors, 90 (55.2%) have accessed non-OVID resources at least once during the reporting period using the individualised CIAP log-in details allocated to them at the onset of the study (Table 3.11). This gives a total page load of 129,040. The average page load per junior doctor was 1434 pages across all resources.

The most popular non-OVID resources were MIMS (87636 page loads), USE (19337) and eTG (12103). The database eTG is Australia's best pre-appraised evidence source for clinicians. Tracking the use of eTG by participants may provide indirect evidence of how well they are keeping up-to-date with the current evidence.

The second highest use of the non-OVID sources was the USE facility, which is a search engine for the whole CIAP website.

It is interesting to note that MIMS was the most frequently used non-OVID source by a large margin. This is a pharmaceutical information resource provided by the pharmaceutical industry and not a pre-appraised evidence resource like eTG. Of the other two pharmaceutical information resources, the Australian Medicine Handbook- which is specific for Australia- had a relatively low amount of page loads (2508), as did the most comprehensive pharmaceutical information resource of Micromedex (2607). It is outside the scope of this project to do other than raise awareness of this issue.

Table 3.11 Frequency of non-OVID resource access from 2008 February to 2009 January in order of increasing usage

	AMH	*MDX*	*ECG*	*eTG*	*USE*	*MIMS*	*Total*
Total number of individuals accessing	49	26	22	53	83	75	90
Total number of page loads	2508	2607	4849	12103	19337	87636	129040
Average number of page loads per person	51	100	220	228	233	1168	1434
Average number page loads per person per month	5	10	22	23	23	117	143

AMH – Australian Medical Handbook
eTG – Electronic Therapeutic Guidelines
MIMS – Prescribing resource
ECG – Interactive Electro Cardiograph Graph Tutorials
MDX – Micromedex
USE – Unified Search Environment

The variation of the monthly access of the non-OVID sources are shown in Table 3.12 and illustrated graphically in Figure 3.1.

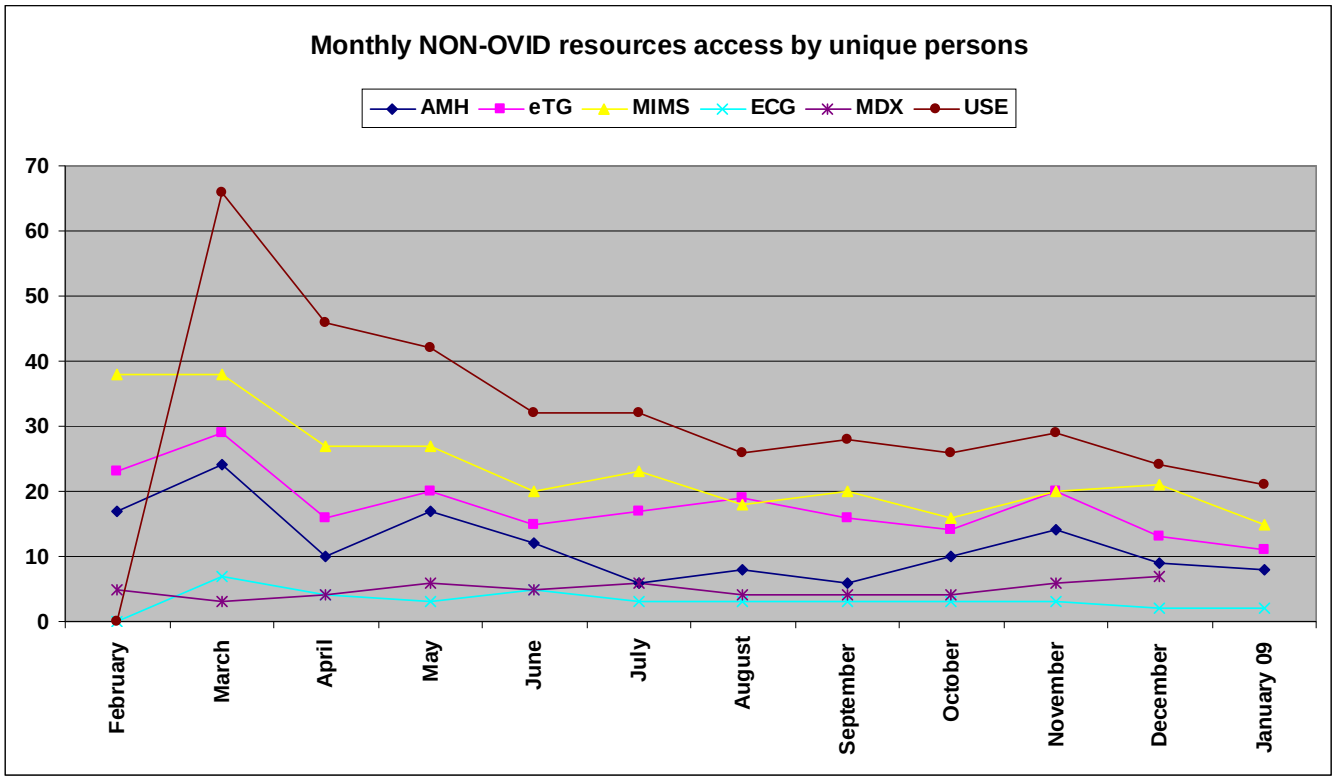
Table 3.12 Frequency of unique person accesses per month for non-OVID (CIAP) resources

	Non-Ovid resources					
Month	*AMH*	*eTG*	*MIMS*	*ECG*	*MDX*	*USE*
February 08	17	23	38	0	8	0
March 08	24	29	38	7	5	66
April 08	10	16	27	4	3	46
May 08	17	20	27	3	4	42
June 08	12	15	20	5	6	32
July 08	6	17	23	3	5	32
August 08	8	19	18	3	6	26
September 08	6	16	20	3	4	28
October 08	10	14	16	3	4	26
November 08	14	20	20	3	4	29
December 08	9	13	21	2	6	24
January 09	8	11	15	2	7	21

Legend as per Table 3.11

The pattern of usage is similar to that presented later for the OVID data. Following the initial high access on most of the resources in March and April, access seems to have decreased gradually over the months to a steady state until November. After November, it can be seen that there is another dip in the access rates. This is also seen for MIMS, which is the most popular resource.

Figure 3.1: Frequency of monthly individual access on non-OVID resources



Legend as per Table 3.11

OVID data

A summary of the OVID data is shown in Table 3.13 and Figure 3.2 for the period January - November 2008. OVID data for December 2008 and January 2009 is not included as it had not yet been made available (at the time of submitting the report) to us by HCN for technical reasons; however, the trends in the data are still observable.

Of the 163 junior doctors in the study, at least 68 (41.72%) have accessed OVID resources at least once. This is less than the non-OVID resource access. For the reporting period, there were 1126 OVID sessions recorded with the 68 users, with a total duration of 480 hours. In a similar pattern to the non-OVID data, the total searches per month seem to reach a peak in March (215). It then fell to the lowest rate in July (42) and picked up again in October to 95.

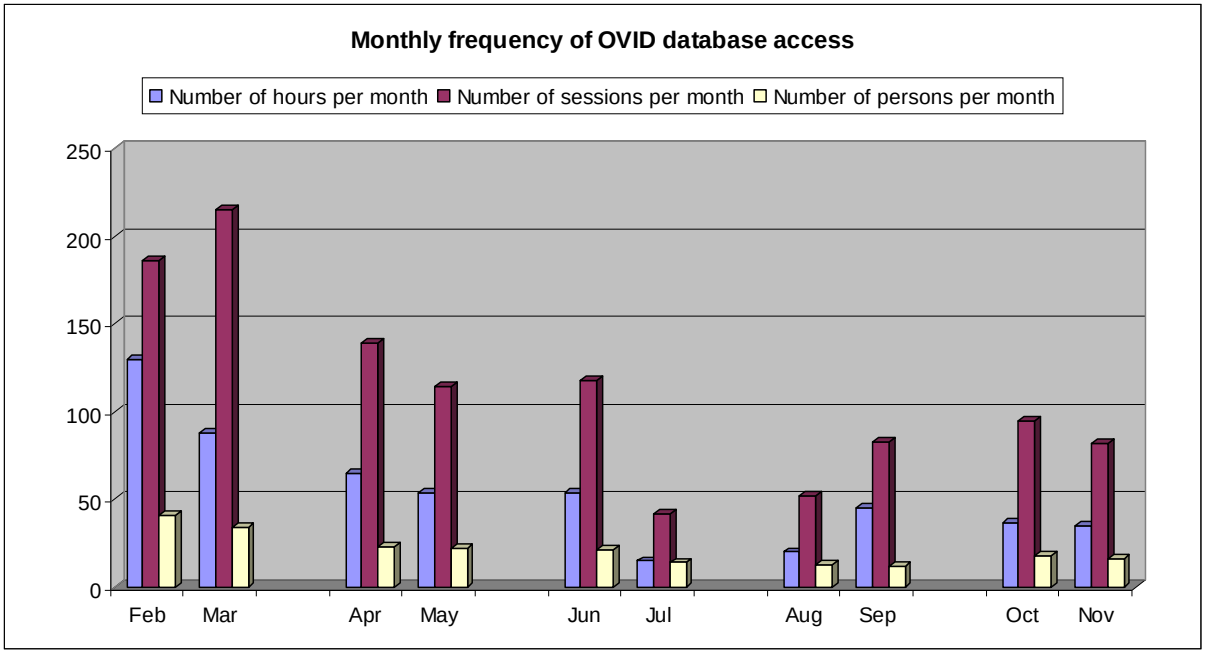
Table 3.13 Frequency of OVID database sessions from February to November 2008

	Feb	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Total search sessions	186	215	139	114	118	42	52	83	95	82
Duration for total search time (hh:min)	64:04	88:08	65:02	54:25	54:00	15:15	20:31	45:37	37:52	35:37
Number of individuals searching OVID	41	34	23	22	21	14	13	12	18	16
Time spent on searching OVID per person (hh:min)	3:10	2:35	2:49	2:28	2:34	1:05	1:34	3:48	2:06	2:13

The number of junior doctors who were engaged in searching OVID resources also decreased from 41 in February to a lowest of 12 in July, which picked up again to 18 in October. The average time spent on searches by one of the junior doctors decreased from three hours and 10 minutes to a lower value of one hour and five minutes per month in July. It seemed to pick up in the following months to three hours and 48 minutes.

Taken together these trends potentially represented two broad possibilities. The first was that learning needs were highest in the beginning of the year after the initial orientation. According to this theory, junior doctors would have needs for searching which would then decrease as they became more comfortable with their performance. The second equally plausible reason was that after initial enthusiasm for the project, the doctors weren't logging in with their individualised CIAP log-ins and we were getting a spurious picture of web activity. Principally this was further investigated qualitatively and the data and interpretation that supports this latter hypothesis are presented in the qualitative analysis section of this report.

Figure 3.2: Monthly frequency of OVID database access



Interns' observed EBM competence (Study Objective 4)

The modification of the previously validated Fresno questionnaire has been described in detail previously in the methods sections. For convenience the modified Fresno test is called the Mini-Fresno test.

Mini-Fresno Scores

Each Mini-Fresno assessment consisted of seven criteria to explore doctors' understanding of the various steps in EBM. Four of the research team acted independently as judges to mark the answer sheets for each of the 26 doctors who completed a mini-Fresno. Three of the judges had taught EBM courses, and the fourth was an experienced educationalist, well-informed about the expected standards of performance for junior doctors. After previous consensus meetings, all four judges had a shared understanding of the expected level of performance of junior doctors.

The marks of each judge's score were averaged for each doctor and the average score across judges and doctors was turned into a final score percentage.

The mean score for junior doctors was 54.6% with a standard deviation of 23.6, confirming the considerable variability in performance.

Reliability of the Mini-Fresno

The Mini-Fresno assessment was investigated in terms of its reliability. There was a close correlation between the markings of each of the four judges**.** Table 3.14 shows the internal consistency of each of the four markers, which is in the range of 0.74 to 0.80.

Table 3.14 Internal consistency of four independent markers

Marker	*Internal Consistency of Marking (Cronbach's alpha)*
1	0.74
2	0.78
3	0.71
4	0.80

The internal consistency of the Mini-Fresno assessment was then examined criterion by criterion for the final score (across four judges). The overall reliability was 0.80, which is at the level expected of a gold standard assessment. In Table 3.15, it can be seen that all of the items contribute to the reliability of the scale. If criterion 6 was removed, reliability would have increased to 0.83.

Table 3.15 Internal consistency (reliability) of the Mini-Fresno tool for measuring the EBM skills of junior doctors

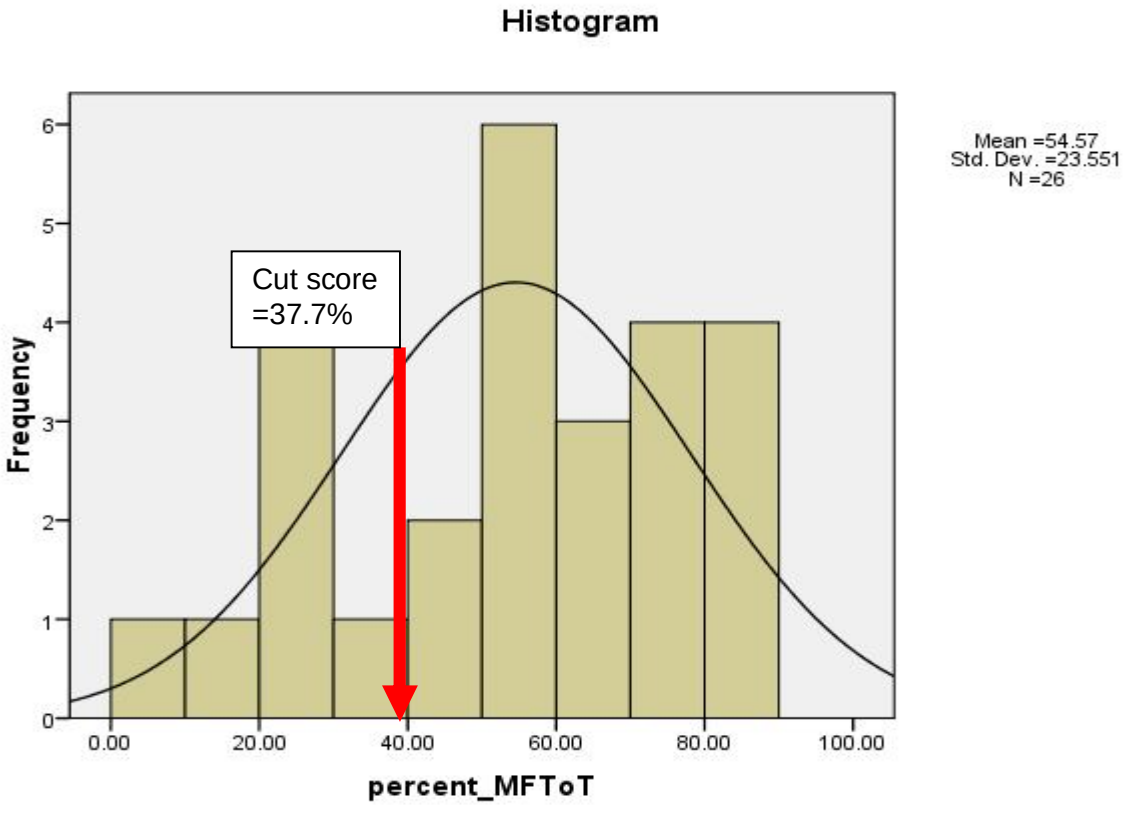
Mini-Fresno Criterion No	*Scale Mean if Item Deleted*	*Scale Variance if Item Deleted*	*Corrected Item-Total Correlation*	*Cronbach's Alpha if Item Deleted*
1	40.27	302.26	0.80	0.80
2	38.44	301.56	0.52	0.80
3	34.92	232.02	0.78	0.74
4	37.04	278.10	0.73	0.78
5	36.73	247.38	0.70	0.76
6	27.77	131.22	0.75	0.83
7	36.94	253.92	0.63	0.77

Decision making and standard setting

In the marking rubric for the Mini-Fresno, each criterion has a score which suggests a level which is labelled “limited skills” in EBM. In adding all of these scores up for each of the criteria, there is a level which corresponds to 37.7%. This can be taken as a cut score. Those junior doctors who score at or below 37.7% can be said to have “limited skills in EBM.” In Figure 3.3 the averaged scores of junior doctors’ ratings (n = 26) on the Mini-Fresno test across four markers showing a cut score of 37.7%

Five junior doctors (19%) scored less than this. There was no significant differences in EBM competence (t test, p = 0.38) between those graduating from USyd (n = 13) and those graduating from UNSW (n = 5). Numbers from other universities were too small to calculate any meaningful differences.

Figure 3.3: Averaged scores of junior doctors ratings (n=26) on the Mini-Fresno test across four markers showing a cut score of 37.7%



Associations between all outcome measures (Study Objective 5)

This section relates to the quantitative data analysis; however, in order to validate the findings of the trends in the web-log analysis as explained earlier in this report, we also present the results of a focussed qualitative analysis which used short semi-structured interviews in the section that immediately follows (Qualitative Analysis)

Relationships between self-confidence in EBM steps, self-reported overall EBM competence, measured EBM competence (Fresno score) and web-log analysis scores

Table 3.16 compares the two perceived EBM confidence scores:

(a) total confidence score for evidence based practice steps
(b) overall EBM confidence score

with the measured EBM score (Fresno score) and the web-log analysis scores for both non-OVID and OVID resources.

Table 3.16 Correlation between self-confidence in EBM steps, global EBM self-confidence, measured EBM competence (Mini-Fresno score) and web-log analysis scores (OVID/Non-OVID) using spearman's rho.

Score	*EBM Checklist*	*EBM Global*	*Mini-Fresno*	*Non-Ovid web logs*	*Ovid web logs*
EBM checklist SEQ1	-	0.51**	0.16	-0.04	-0.01
Global EBM - SEQ1		-	0.41*	-0.07	-0.05
Mean Fresno Score			-	-0.02	-0.02
Non-Ovid weblogs				-	0.86**
Ovid weblogs					-

*** p < 0.01 (2 tailed)* * *p < 0.05 (2 tailed)*

The more important finding is that there appears to be no relationship between the observed competences of junior doctors as measured by their Mini-Fresno scores and their self reported estimates of their competence in each of the six steps of EBM. The finding of a modest relationship between observed and self-estimated competence (r = 0.41) is common throughout the assessment literature; however, the conclusion is that only 16% of the variance in EBM competence is explained by the self-rated global estimate of EBM skills.

This also suggests that the global rating EBM score is testing something different than the six steps of the EBM process. Also of significance was the finding of no particular relationship between the amount of resources looked at and either self-estimated or observed competence in EBM. However, as mentioned previously, this finding also most probably reflects the uncertainty of the reliability of the web-log analysis.

The correlation (spearman's rho, r= 0.86) between the use of OVID and Non-OVID source use was apparent from the patterns of web-log usage. This means that the junior

doctors who have been accessing the Non-OVID resources (mainly drug and pre-appraised evidence) also searched the OVID databases.

Relationship between EBM, IT and clinical skills

Next the relationship between global self reported estimates of EBM skills, IT skills and clinical skills was compared. Table 3.17 shows a modest but significant correlation between overall ratings of EBM skills with IT skills (spearman's rho, r = 0.38) and a more modest relationship between EBM and clinical skills (r = 0.24). As expected, no relationship was found between IT skills and clinical skills (r = 0.06).

Table 3.17 Correlations between overall self ratings in EBM, IT and Clinical Skills

Overall Confidence	*IT*	*EBM*	*Clinical Skills*
IT	1.000	.38*	.06
EBM		1.00	.24*
Clinical Skills			1.000

** Correlation is significant at the 0.01 level (2-tailed)*

Relationship between self-rated competence in EBM and use of EBM databases

There was a modest significant relationship between over self-rated competence in EBM skills and the use of PubMed (spearman's rho, r = 0.48), OVID (r = 0.52), and Cochrane (r = 0.42). There was only a very small relation between overall EBM skills and the use of eTG (r = 0.17) and Up-to-Date (r = 0.19).

Qualitative analysis (Study Objective 5)

Initially the study was intended to be quantitative; however, given the data patterns that were emerging in the web-log usage and the attrition rate of the web-log study cohort from 163 to 28, it was determined by the project group to seek additional qualitative information. After six months, CIAP web-logs showed two groups: those who had never or barely ever logged into CIAP- low end users (LEUs)- and those with a high CIAP log-in frequency- high end users (HEUs). The HEU group was the clear minority. There was also the pattern of initial high usage and fall off of the web-log activity noted earlier, which required further explanation.

We had also noted the lack of correlation of the web-logs with our other outcome measures. We also noted that the Mini-Fresno score was intended to measure EBM activity, but the most common activity for junior doctors was looking at pre-appraised evidence. This raised concerns about the validity of the Mini-Fresno score in the context of junior doctors. Finally, we were interested to know some of the factors that under-pinned the experience of practicing EBM within a busy ward environment, which would assist in the further interpretation of our quantitative data and provide richness to our training recommendations.

We explored these factors by conducting semi-structured telephone interviews with a 50 percent sample of the initial cohort with representation respectively with LEU and HEU groups.

Methods

Data from 71 telephone interviews were analysed using Framework Analysis. Multiple researchers (n = 3) analysed a proportion of the data and developed a thematic framework capturing content related (i.e. what was said) themes emerging from the data. This thematic framework was then used to code the complete data set.

Research Questions

The following questions were asked of the qualitative data set:

1. What were the main reasons why the junior doctors didn't fully participate in the study?
2. What were the patterns of EBM resource usage of the junior doctors who didn't use the log-in?
3. What was the user experience of using CIAP?
4. What was the validity of the web log analysis data (i.e. how often did they use EBM study log in) of those in the study group?
5. What were the junior doctors' perceptions of their change of usage of EBM resources throughout the year in the context of their increasing clinical experience?

Data Analysis

1. What were the main reasons why the junior doctors didn't fully participate in the study?

It was immediately apparent from the qualitative data that the finding from the quantitative study indicating that there were two groups of users- so called high end and low end- was an artefact of the study. The majority of doctors had found that, because the hospital computers were permanently logged on, it was extra and unwelcome effort to log-in with the individualised log-in details provided. Some cited time constraints, others lost passwords and others said they had difficulty with access using the password they had.

Of particular interest were a small group of doctors (n = 8/60, 13%) who not only didn't log-in to the study but also barely used CIAP or "*nowhere near as much as I thought I would use it."* Of this group (n = 3/60, 5%), there appeared to be a lack of inquisitiveness on the behalf of the doctors. They suggested that they were merely doing what they were told to do:

> *"Generally the questions I have are things I answer myself or other people answer, generally my supervisors will just tell me. So when we are doing the rounds a question will come up and the superior will tell you the solution."*

2. What were the patterns of usage of the junior doctors of typical evidence based resources including CIAP?

Of the doctors who did not use their individualised log-in (n = 60), 41% said they used CIAP more than once a day. This compares with 32% of the study (those who often used the individualised log-in) group who claimed to use CIAP more than once per day. Twenty-one percent of the interview sample of doctors who didn't use their individualixed log-in said they used CIAP at least once per day. This compares to 7% of the study group.

Over half of these doctors were using Up-to-Date as their preferred source of information (n = 32/60, 53%) with a number using Google (n = 27/56, 45%); however, it appears that only 13 doctors (22%) mainly used CIAP as their preferred method of accessing information. This group used CIAP to access EBM type resources i.e. Medline, Pubmed, Cochrane and clinical and therapeutic guidelines.

3. What was the user experience of using CIAP?

There were broadly four themes that were consistent in the junior doctor's experience of accessing information sources within CIAP. These were:

1. Time management/navigation issues,
2. Clinical decision making opportunities,
3. Desire of pre-appraised evidence for example Up-to-Date, and
4. Educational possibilities.

Time management / navigation issues

There was recognition that the CIAP interface had been updated recently and was consequently much easier to use. There was widespread support that the principles of CIAP in providing timely access to a range of resources were important:

> *"It's great that there is a centralised information system available, where we can look at books and journals and whatever resources we need all on the one site. It makes it really easy."*

At the other end of the spectrum others found using CIAP challenging:

> *"I think the search engines are difficult to use. It's not very efficient. You never really find what you want."*

In terms of preparation for work-based learning in the intern year, it was noted that there was a huge transition from using university-based systems for clinical information searching to relying on CIAP:

> *"As med students we were properly trained on how to do it [Medline], but nothing else, so I never really figured out how to use other resources, and that's why I don't really know any other resources as well…I think now that CIAP has so many resources I think the University, you know, medical students should be trained how to use CIAP rather than just focusing on Medline…once we get into the habit of using them, we will actually refer to them when we need it."*

This observation raises the possibility that preparation for CIAP in NSW universities, or, for example the Clinician Knowledge Network (CKN) in Queensland, could begin in the pre-Internship term as part of the work preparation of senior medical students.

Clinical decision making opportunities

It appeared universal that apart form some specific terms there were few opportunities that junior doctors recognised were they could "*change that much about what I'm doing."* One doctor went on to explain:

> *"But if someone's doing something and you're not quite sure why they are doing it or if you haven't heard of a drug being used in a certain situation, then it's useful to look up the evidence. But as an intern I'm not organising the treatment of any patients."*

For some junior doctors, EBM resources were seen as only necessary for those engaged in specialist training. For these junior doctors, there seemed little recognition that they too would be specialists or GP registrars in a discipline area within a period of two years. In explaining why they hadn't done any Medline or Cochrane searches, one doctor said:

> *"I don't search for questions and topics like that, or articles....I don't think it's necessary to try and read articles at my level. In terms of specialists, then you probably need it a lot more."*

For others there was recognition that even though the supervisor did not practice evidence based approaches there were educational possibilities:

> *"The main reason why we don't use CIAP is because as interns we don't make decisions; we just carry out the wishes of consultants. So we don't need evidence, we do what they tell us. If we do look up CIAP, it's more for our own interest, because otherwise we are going against what we are told, which we don't really want to do."*

One of the more intensive terms is Emergency Medicine, and clinical decision making by junior doctors occurs on a frequent basis. There appeared to be a more engaged approach to engaging with the evidence by junior doctors in this setting:

> *"In emergency you cannot do your job without it. You see so many random things you constantly have to look up. Even my bosses use it.*

It appears that using EBM was more of an academic exercise for the motivated and was not worth doing for the unmotivated. This observation suggested that the there was no particular link developed in junior doctor training where clinical information gathering was linked with learning and enhancing clinical reasoning. This should be addressed by exploring supervisors' attitudes to the use of CIAP and promoting the process where new clinical knowledge is integrated into both patient care and the junior doctors' developing clinical reasoning.

Desire of pre-digested evidence (e.g. Up-to-Date)

There was widespread recognition throughout all of the interviews that the preferred approach to looking up information at this level was one of using Up-to-Date and Therapeutic Guidelines. These are what are referred to in the literature as pre-appraised evidence. Comments such as quick, convenient and easiest abounded. A typical comment was:

> *"I found the easiest and quickest way of looking things up was to go to the summary websites like Up-to-date where they already have the information synthesised for you."*

At the moment Up-to-Date isn't included within CIAP. It was apparent that the observations of the junior doctors reflected the quantitative findings that junior doctors were by and large using pre-appraised information. If there was time, academic interest, or educational requirements, junior doctors might go on to look at journal articles. Prescribing support through MIMS was particularly appreciated.

Educational possibilities

Formative assessment within particular rotations was one incentive to use CIAP that was recognised:

"Basically the rotations that require you to do presentations I use it more often…I had to do presentations for both O&G and paediatrics so I used it quite often at that time…emergency we don't really use that much and relief term…"

This raises the possibility that supervisors and medical education unit staff could be encouraged to emphasise the use of CIAP in both formal and informal teaching sessions. There are a number of tools developed by the EBM community for the teaching and learning of EBM that could be adapted for particular contexts. These have been elaborated on by, for example, Forrest and Robb.[20]

4. *What was the validity of the web log analysis data (i.e. how often did they use EBM study log in) of those in the study group?*

Within the group who were using the individualised log-in details, there was considerable variation in the proportion of times they used CIAP with their individualised log-in compared with the times they used a hospital computer which was already logged on. There was a variation in the way they logged in from 15 to 90 percent of the time:

"I probably used it more at first, but often in emergency the computers are already logged in, so in my last term I probably only logged in 10-15% of the time…in my first term I didn't use CIAP that much but when I did it was at home so it was more like 80% of the time."

This observation, which accords with the observation made in Table 3.5, means the web-log analysis data needs to be treated with caution. However, it remains a recommendation that one way forward is through better technology to track individual junior doctors.

5. *What were the junior doctors' perceptions of their change of usage of EBM resources throughout the year in the context of their increasing clinical experience?*

There was the perception that usage varied with the type of term and the workload attached to the particular term:

"I found that I used the most CIAP during my emergency term. I'd look things up when I'd see a patient and that sort of thing. But during the really busy medical terms, like I did geriatrics, and I just found that I was really busy and that I barely had time to do anything else…When I did neurology I used quite a lot…so I'd say generally more in medical terms than the surgical terms, but not really in the busy medical terms."

The observation that the use of CIAP began high and then tailed off over the months would seem to be due entirely to a study artefact where the junior doctors weren't logging in using the study ID.

4. Discussion

Main findings

This study is unique in that it is the first time within Australia that data has been provided on the EBM practices of junior doctors, particularly around their use of a clinical information access system (CIAP). The main findings of the study are that:

- Newly graduated doctors generally rate themselves as confident in their EBM skills
- There is no strong relationship between junior doctor's self-rated competence and their actual competence at EBM
- There is an estimated 14% of doctors who barely use CIAP or other sources of evidence.
- Nearly a fifth of junior doctors may only have limited skills in EBM as evidenced by the Mini-Fresno test
- The Mini-Fresno test is confirmed as a highly reliable and feasible measure of junior doctors EBM skills; however there is a question mark about its validity, in that junior doctors' clinical needs are in pre-appraised evidence, as opposed to those aspects of EBM which are strongly epidemiologically based.
- There are a number of interesting trends in the use of particular EBM resources. The principal finding is that junior doctors by and large are using pre-appraised sources of evidence for example Up-to-Date. It may be that critical appraisal skills using journal articles are remaining static or decreasing throughout the year.
- Many junior doctors get few opportunities in their workplace to get feedback from supervisors or colleagues to demonstrate their EBM learning.
- Work-based learning seems to be the preferred method on building upon the existing skill set in EBM.
- Web-log analysis is a potentially useful quality assurance and research tool. However, there are issues with the reliability of the data in this study, principally because web-logs can only be tracked if there is an individualised log-in.
- There is a significant use of clinical information resources around prescribing.
- Advanced EBM skills are practiced by the minority and usually out of work time for academic reasons.

Implications

The implications of these findings are considered in terms of each of the study objectives.

Study Objective 1: Assess any associations between EBM performance and internship appointment, location, rurality of the internship hospital, medical school, time from graduation and other demographic factors

The cohort that was initially recruited represented 12% of the total cohort of junior doctors in the first two years post graduation within New South Wales. Little useful data could be reported on this objective of the study, which was designed to determine whether there were any significant predictive factors on junior doctor EBM performance; for example, which university they qualified in. This was because the number of doctors who completed the Mini-Fresno was not sufficient to produce a meaningful analysis.

Data was investigated to see if there were some relationships between self-rating in confidence in each of the steps of EBM; however, the finding that there is no particular relationship between self-rated EBM confidence and actual performance- a common finding in the broader assessment literature- suggests that such findings are of little educational significance. A typical finding in the self confidence scale is, for example, that males rate their performance better than females in critically appraising the evidence (t test, $p = 0.02$) and integrating clinical information into existing knowledge ($p = 0.01$). This reflects the common observation that males overrate their performance compared with women. However, for the observed test of EBM skills (the Mini-Fresno) there was no significant difference in performance by either gender ($p = 0.28$) or university.

Study Objective 2: Evaluate the perceived EBM competence as perceived by interns using a self-assessment questionnaire

The junior doctors' perceived competence in EBM varied for the different steps of EBM, with the highest confidence for "formulating a clinical question," and lesser confidence for the later steps in EBM, particularly around "changing clinical practice in the light of evidence" (Table 3.3). It seems that the junior doctors' perceived EBM steps confidence scores do not show a correlation with the measured Mini-Fresno test scores (Table 3.16). The most useful aspect of self-assessment is not its ability to predict future performance, but rather as a learning tool which could be used at term orientations or midpoint assessments to identify learning needs and plan for learning activities which will address important gaps in knowledge and skills, both in terms of educational process using the EBM framework and in terms of clinical knowledge.

Study Objective 3: Determine the trends of web access of CIAP EBM resources by interns using web-log analysis (WLA).

One of the main issues with junior doctors is the problem of lack of time.[27] This explains our observation (which was later confirmed by the junior doctors in telephone interviews) about the minimal time spent on information access using internet based sources.

The observation in the literature that junior doctors may be overly reliant on colleagues and text books[20,21,23] is confirmed by this study. It was, however, reassuring that CIAP was one of the most frequently used information sources by the majority of junior doctors: at least once a day, second only to their peers and colleagues.

The finding that Up-to-Date was the most popular source of information in this study is in contrast to previous studies which found that Medline was the most consulted source.[17,20,22] The non-OVID resources (MIMS, AHM, eTG) were accessed by more junior doctors at a higher frequency than the OVID (Medline and Journals). There were no previous studies that we could find that provide such good data in demonstrating the clear preference for using pre-appraised evidence as is found in Therapeutic Guidelines compared with Journal type databases such as MEDLINE. The finding that the Cochrane library- a gold standard EBM resource- was not widely used also echoes previous studies.[21-23]

Westbrook et al[16] suggest that clinicians' CIAP use increased with patient admissions to hospitals, supporting the hypothesis that clinicians' use of evidence is related to direct patient care. This study did not differentiate the 'clinicians' by domain or by seniority. However, our study confirms that information access during hospital working hours is confined mainly to referring drug related databases such as MIMS, AHM and MMD. The OVID database searches which indicated searching for foreground information[28] for EBM was the exception for a minority of junior doctors. It was interesting to note that OVID

searches were mainly done from home by junior doctors. The junior doctors' frequent access to resources such as eTG indicates they may search for foreground information mainly in pre-appraised information sites.

A finding that was not addressed in the initial research objectives relates to prescribing competence. The majority of junior doctors' interviewed when accessing CIAP estimated that their principle reason was to query drug related databases such as MIMS and AMH, and secondly to access guidelines, particularly eTG. Opportunities exist in future research to investigate this phenomenon and its relationship to competence in prescribing.

It is paramount that NSW Health addresses the needs of junior doctors where the emphasis is on rapid access to pre-appraised evidence on the core clinical problems that are likely to present to junior doctors in their work. Many of the EBM resources that are available are more likely to be used currently by those doing "academic" presentations (which should be encouraged) and those preparing to progress to basic specialty training, where these advanced skills are an expected exit learning outcome as specified by the Australian Curriculum for Junior Doctors. It would seem, however, that there is still research to be undertaken to uncover the most effective methods of encouraging clinicians to use the best evidence in everyday practice.

Study Objective 4: Evaluate the EBM competence of interns using a validated web-based knowledge and skills test (Fresno Test)

The finding that the modified Fresno (Mini-Fresno) enjoyed high reliability was encouraging. It confirms earlier work by Ramos et al.[25] However, high reliability on its own isn't enough to confirm the utility of a test, and validity is also an important aspect. In this cohort of junior doctors, much of the variability in marks in the Mini-Fresno assessment related to those questions which were about the statistical concepts of EBM. This finding of an apparent weakness in the bio-statistical sciences has also been found in other studies about junior doctors.[29] Forrest and Robb[20] suggest that the way to approach this apparent deficiency is to offer junior doctors face-to face courses and on-line courses and journal clubs. However, this view of education as the passive transmission of information has become dated in the light of newer thinking about how people learn when they are at work.[18] The junior doctors themselves are clearly using pre-appraised evidence rather than the full cycle of EBM, which is also stated as an advanced skill within the Australian Curriculum for Junior Doctors. Their main opportunity for demonstrating their competence in EBM is during sessions with clinical supervisors and colleagues. If we are serious about developing authentic and valid assessments of junior doctor performance in using clinical evidence, it is important that it is this work-based learning process that has to be measured and timely feedback provided. Newer notions of work-based assessments[18] provide a mechanism of how this type of assessment can be included in the supervisory process. This would also concur with the approach taken by the CPMEC National Steering Group, which has significant junior doctor input of the Australian Curriculum for Junior Doctors in encouraging this type of supervisory activity as opposed to developing more passive teaching and learning resources.

Study Objective 5: Determine the associations between the Fresno scores, WLA and self-assessment questionnaire scores.

This study found that the initial overall perceived EBM score showed a significant correlation with Mini-Fresno scores. This finding concords with a systematic review that showed the accuracy of physician self-assessment compared with observed measures of competence has a limited ability to accurately self-assess.[30] The lack of a relationship

between the web-log analysis and other factors of interest was not surprising in view of the major reliability issues with this aspect of the study. This was investigated both from a review of the qualitative and the quantitative data. This is an aspect that will require further refining of web-log methodology in future research.

Study Objective 6: To bring together evidence from existing literature and from the experiences of the project team and stakeholders to produce a preliminary analysis of the perceived competencies and training needs of junior doctors for EBM

The Australian Curriculum for Junior Doctors already provides clear learning outcomes for the processes of EBM during the first two years of postgraduate training. The ACFJD also indicates the common clinical problems that junior doctors need to have the knowledge, skills and behaviours to manage patients. This study shows that 90% of the cohort felt competent in their global EBM skills. However, this needs to be contrasted with the 14% who were shown to have limited skills in EBM when they were assessed. The answer, however, is not as Forrest and Robb[20] have suggested (more didactic resource based sessions). It has to be assumed that the university sector is broadly doing its job to promote EBM skills in medical degree programs. Rather, the nature of junior doctors' evidence based behaviours should be considered when developing a framework to meet the training needs of junior doctors. The principle need seems to be one of rapid access to pre-appraised evidence and prescribing information at or near the point of patient care. Junior doctors require formative feedback in the workplace that they have integrated newly acquired clinical information into their daily practice. This is a feature provided by work-based learning techniques.[18] However, it does place the onus on supervisors and clinical teachers to incorporate an evidence based approach into their teaching. The emphasis should be on getting the junior doctors themselves to present the evidence rather than it being presented to them. There are various educational strategies which have been reported in the medical education literature. One example is SNAPPS.[31] This is an acronym for a brief educational intervention, developed to support the clinical reasoning of medical students, but suitable for junior doctors. In a SNAPPS session they would recognise their learning needs in relation to clinical cases they had seen and be able to look up pre-appraised evidence to add to their knowledge. Mini-CEX can be modified to give feedback on junior doctors' performance and their engagement with the evidence base.

Figure 4 The SNAPPS model of a brief intervention to support self-directing acquisition of the evidence base to support clinical reasoning.

- SUMMARIZE briefly the history and findings
- NARROW the differential to two or three relevant possibilities
- ANALYZE the differential by comparing and contrasting the possibilities
- PROBE the preceptor by asking questions about uncertainties, difficulties or alternative approaches
- PLAN management for the patient's medical issues
- SELECT a case-related issue for self-directed learning

The more advanced skills of EBM, particularly in critically appraising journal articles, needs to be catered for as it is an expected learning outcome within the ACFJD. The approaches suggested by the EBM teaching and learning community[20-22] with journal clubs and short evidence based courses should continue to cater to those who identify this as a learning requirement for their future basic and advanced training needs.

Study Objective 7: Make recommendations on strategies for the enhancement of EBM in PGY1 and 2 to relevant bodies.

The following recommendations are presented for consideration by stakeholders who have an interest in the clinical performance of junior doctors and its relationship with evidence based practice:

1. EBM skills are recognised as graduate attributes and the university sector needs to ensure that EBM skills are an assessable graduate attribute.

2. Universities should consider engaging with the jurisdictions to arrange for students in their pre-internship terms to have access and training in systems for example CIAP in NSW or the Clinical Knowledge Network in Queensland.

3. Supervisors need to consider giving formative feedback on their trainees observed performances where evidence is important in developing junior doctors' clinical reasoning skills.

4. Self-assessments of competence in the steps of EBM should be encouraged by supervisors at the time of term orientations and mid-point assessments as a means of identifying learning needs in EBM.

5. Organisers of junior doctor education and training programs need to build EBM into current best practice frameworks in work-based learning e.g. clinical reasoning sessions, teaching opportunistically around ward rounds, case based discussions or within seminars, or formal presentations.

6. Educational researchers should consider the use of the modified Fresno test for use in other groups of healthcare professionals as it is highly reliable and can be used conveniently as a measure of EBM skills.

7. Educational researchers need to develop a reliable instrument which has greater validity for measuring the integration of pre-appraised evidence into clinical practice and is seen as a valuable source of feedback in the context of junior doctors.

8. The web-log analysis methodology is a potentially powerful tool to measure clinical information searching activity of healthcare staff and with appropriate modifications and safeguards should be incorporated into routine quality assurance systems by the healthcare informatics community.

9. The needs of low users of clinical information need to be investigated by the healthcare informatics community to determine user characteristics and their specific needs within CIAP.

10. In order to determine the relationship of clinical information searching with enhanced safe patient care, a technological/incentive solution for individual tracking needs to be found by the health informatics community.

11. The most appropriate sources of pre-appraised evidence needs to be included within CIAP, recognizing that most junior doctors are using Up-to-Date, a source of pre-appraised evidence which is currently not contained within CIAP.

12. Educators need to work with informatics experts to ensure the CIAP system includes educational materials which support the integration of EBM learning in the workplace, particularly around pre-appraised sources of evidence. Such

packages could be available on line or delivered with seminars in the clinical environment.

13. Educators need to develop a framework where opportunities are provided for junior doctors to develop and receive feedback on advanced skills of critical appraisal, and exit learning outcome set by the Australian Curriculum for Junior Doctors.

14. The professional colleges need to ensure their basic training courses address the lack of progress, or even decline for most junior doctors in advanced evidence-based skills.

Study strengths and limitations

There were a number of strengths to the study, in piloting a relatively innovative methodological approach. Additional qualitative data was able to unpack some of the quantitative findings. Whilst the findings are specific to junior doctors, the methods are generalisable to a range of other healthcare professionals including trainees, specialists, general practitioners (including registrars), and within nursing.

There were a number of recognised limitations to this study. Whilst we are grateful for the cohort of around 28 doctors who fully participated in most aspects of the study, the attrition rate from the initial cohort (n = 163) was high. Whilst web-log analysis has the potential to be a powerful tool in quality assuring resource intensive tools such as CIAP, we recognise web-log activity may be a significant underestimate of the actual use of CIAP by junior doctors compared with their self-estimates of usage. This was principally due to perceived issues for the junior doctors using individualised log-ins when accessing CIAP.

Conclusions

This is the first time that a detailed insight has been provided into the evidence based behaviours of junior doctors working in the NSW Health hospital sector. Junior doctors perceive of themselves as having little direct clinical decision making responsibilities, with the possible exception of the emergency term. Accordingly, they acquire much of their new clinical knowledge from colleagues and peers. However, junior doctors do regularly access clinical information sources. The principal reason appears to be for prescribing guidance.

The next important reason is to gain access to pre-appraised forms of evidence. Those practicing the advanced skills of EBM seem to do so in their own time for academic interest or to support academic activities such as clinical presentations for educational meetings. The conclusion of this report is that the Australian Curriculum for Junior Doctor's (ACFJD) has been designed to integrate the practice of evidence based medicine into supervisory arrangements and education and training programs for junior doctors, but there is much work to be done in developing appropriate methods and gaining traction in promoting cultural change in a busy service-driven clinical environment. Postgraduate medical educators need to come together with the health informatics community to ensure that adjustments are made to the CIAP system so that rapid access to contemporary sources of pre-appraised clinical evidence- including prescribing information- is available to junior doctors at the point of patient care. There will be a burden on supervisors to adjust to the cultural changes required by the

implementation of the ACFJD, but this is now a national movement that is gaining momentum across the jurisdictions. Future research activities in this area need to be pragmatically focussed around policy development and guiding educational and training strategies that incorporate the evidence base into junior doctors clinical reasoning processes.

Dissemination

Preliminary results from this study were presented at last year's Association for Health Professional Education's (ANZAME) annual conference (12 July 2008, Sydney NSW). Participants were also informed of preliminary results via email midway through the study. Two abstracts for this year's ANZAME annual conference have also been accepted for presentation (30 June – 3 July 2009, Launceston TAS).

5. References

1. The Australian Medical Council http://www.amc.org.au/ (accessed 13 June 2009)

2. The Australian Curriculum Framework for Junior Doctors. Confederation of Postgraduate Medical Education Councils http://www.cpmec.org.au/Page/acfjd-project (Accessed 13 June 2009)

3. Grol R, Grimshaw J: From best evidence to best practice: effective implementation of change in patients' care. Lancet 2003; 362:1225-30.

4. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. N Engl J Med 2003; 348: 2635-45.

5. Mangione-Smith R, DeCristofaro AH, Setodji CM, Keesey J, Klein DJ, Adams JL, Schuster MA, McGlynn EA The quality of ambulatory care delivered to children in the United States. N Engl J Med 2007 Oct 11; 357(15): 1515-23. PMID: 17928599 [PubMed - indexed for MEDLINE]

6. Toulkidis V, Donnelly NJ, Ward JE. Engaging Australian physicians in evidence-based medicine: a representative national survey. Internal Medicine Journal 2005; 35(1): 9–17.

7. Coomarasamy A, Khan KS: What is the evidence that postgraduate teaching in evidence based medicine changes anything? A systematic review. BMJ 2004; 329: 1017.

8. Norman GR, Shannon SI: Effectiveness of instruction in critical appraisal (evidence based medicine) skills: a critical appraisal. CMAJ 1998; 158: 177-81.

9. Green ML: Graduate medical education training in clinical epidemiology, critical appraisal, and evidence-based medicine: a critical review of curricula. Acad Med 1999; 74: 686-94.

10. Flores-Mateo G, Argimon JM. Evidence based practice education in postgraduate health care: a systematic review. BMC Health Services Research 2007; 7:119.

11. Caspi O, Mcknight P, Kruse L, Cunningham V, Figueredo AJ, Sechrest L. Evidence-based medicine: discrepancy between perceived competence and actual performance among graduating medical students. Medical Teacher 2006; 28(4): 318-25.

12. McColl A, Smith H, White P, Field J. General practitioners' perceptions of the route to evidence based medicine: a questionnaire survey. BMJ 1998; 316: 361-65.

13. Riordan FA, Boyle EM, Phillips B. Best paediatric evidence; is it accessible and used on-call? Arch Dis Child. 2004; 89(5): 469-71.

14. Scott I, Heyworth R, Fairweather P. The use of evidence-based medicine in the practice of consultant physicians - results of a questionnaire survey. Aust NZ J Med 2000; 30: 319-26.

15. CIAP – Clinical Information Access program. http://www.ciap.health.nsw.gov.au/ (Accessed on 30th July 2007)

16. Westbrook JI, Gosling S, Coiera E. Do clinicians use online evidence to support patient care? A study of 55,000 clinicians. J Am Med Inform Assoc 2004; 11:113–20. DOI10.1197/jamia.M1385

17. Westbrook JI, Gosling AS, Westbrook MT. Use of point-of-care online clinical evidence by junior and senior doctors in New South Wales public hospitals. Internal Medicine Journal. 2005; 35(7): 399-404.

18. Norcini JJ. Work based assessment. BMJ. 2003; 326(7392): 753-5.

19. Bazarian JJ, Davis CO, Spillane LL, Blumstein H, Schneider SM. Teaching emergency medicine residents evidence-based critical appraisal skills: a controlled trial. Annals of Emergency Medicine. 1999; 34(2):148-54.

20. Forrest M, Robb M. The information needs of doctors-in-training: case study from Cairns Library, University of Oxford. Health Libraries Review. 2000; 17(3): 129-35.

21. Oliveri RS, Gluud C, Wille-Jorgensen PA. Hospital doctors' self-rated skills in and use of evidence-based medicine- a questionnaire survey. Journal of Evaluation in Clinical Practice. 2004; 10(2): 219-26.

22. Shirkhedkar P, Day AS. Medical literature search practice in paediatric junior medical staff: a questionnaire study. Informatics for Health & Social Care. 2008; 33(1): 69-75.

23. Ahmadi-Abhari S, Soltani A, Hosseinpanah F. Knowledge and attitudes of trainee physicians regarding evidence-based medicine: a questionnaire survey in Tehran, Iran. Journal of Evaluation in Clinical Practice. 2008; 14(5): 775-9.

24. Flores-Mateo G, Argimon JM. Evidence based practice in postgraduate healthcare education: a systematic review. BMC Health Services Research. 2007; 7: 119.

25. Ramos KD, Schafer S, Tracz SM. Validation of the Fresno Test of competence in evidence based medicine. BMJ. 2003; 326: 319-21.

26. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A, Burgess R, editors. Analyzing Qualitative Data. London: Routledge; 1994.

27. Westbrook JI, Ampt A, Kearney L, Rob MI. All in a day's work: an observational study to quantify how and with whom doctors on hospital wards spend their time. Med J Aust. 2008 May 5; 188(9): 506-9.

28. Strauss SE, Richardson S, Glasziou P, Haynes B. Evidence Based Practice. 3rd edition. Churchill Livingstone, 2005.

29. Windish DM, Huot SJ, Green ML. Medicine residents' understanding of the biostatistics and results in the medical literature. JAMA. 2007 Sep 5; 298(9):1010-22.

30. Davis DA, Mazmanian PE, Fordis M, Van Harrison R, Thorpe KE, Perrier L. Accuracy of physician self-assessment compared with observed measures of competence: a systematic review. JAMA. 2006 Sep 6; 296(9): 1094-102.

31. Wolpaw T, Papp KK, Bordage G. Using SNAPPS to facilitate the expression of clinical reasoning and uncertainties: a randomized comparison group trial. Academic Medicine. 2009; 84(4): 517-24.

6. Appendices

Appendix A- Self-assessment questionnaire 1 (SAQ1)

Given Name _____ **Surname** _____

Primary email _____

Secondary email (not required) _____

Mobile No _____ **Alternate contact no** _____

Did you obtain your primary medical degree in Australia?

O Yes - University I graduated from:

_____

O No – I obtained my medical degree from (please select):

- O Asia (China and SE Asia) not including India
- O Africa
- O Canada
- O Europe
- O India
- O Middle East
- O UK and Ireland
- O United States
- O Other

What is your age group?

O 20 – 25
O 26 – 30
O 31 – 35
O 36 – 40
O 41 – 45
O 46 – 50
O 51 – 55
O over 55

What is your gender?

O Male
O Female

Which year of training?

O PGY1
O PGY2

What type of placement is your FIRST term?

O Metro

O Outer metro

O Rural

What type of placement is your SECOND term?

O Metro

O Outer metro

O Rural

What is the predominant language spoken in your home?

O English

O Other

A. How do you rate your confidence in the following aspects of evidence-based medicine in doing your job as an intern?

		Poor	Fair	Good	Very good	Excellent
A1	Converting the need for information (e.g about prevention, diagnosis, prognosis, therapy, causation, etc.) into an answerable question	☐	☐	☐	☐	☐
A2	Tracking down the best evidence with which to answer your question	☐	☐	☐	☐	☐
A3	Critically appraising the evidence (e.g in terms of validity, impact, and applicability)	☐	☐	☐	☐	☐
A4	Integrating this new information with what you already know (e.g your clinical expertise, patient's unique biology, values, and circumstances)	☐	☐	☐	☐	☐
A5	Changing your practice in light of the evidence you have found.	☐	☐	☐	☐	☐
A6	Evaluating the performance of your decision (e.g in terms of effectiveness and efficiency)	☐	☐	☐	☐	☐

B. How do you rate your competence in using the following databases/search engines?

	Rarely or never used	Poor	Fair	Good	Very good	Excellent
B1 PubMed	☐	☐	☐	☐	☐	☐
B2 Ovid Medline	☐	☐	☐	☐	☐	☐
B3 Cochrane library	☐	☐	☐	☐	☐	☐

	Rarely or never used	Poor	Fair	Good	Very good	Excellent
B4 Pre-appraised evidence						
B4.1 eTG (Electronic Australian Therapeutic Guidelines)	☐	☐	☐	☐	☐	☐
B4.2 BMJ Clinical Evidence	☐	☐	☐	☐	☐	☐
B4.3 UpToDate	☐	☐	☐	☐	☐	☐
B4.4 DynaMed	☐	☐	☐	☐	☐	☐
B4.5 BestBets	☐	☐	☐	☐	☐	☐

Other databases you use (please specify below)

B4.6 _____

B4.7 _____

B4.8 _____

	Rarely or never used	Poor	Fair	Good	Very good	Excellent
B5 General search engines for clinical problems						
B5.1 Google	☐	☐	☐	☐	☐	☐
B5.2 Google Scholar	☐	☐	☐	☐	☐	☐
B5.3 SCIRUS	☐	☐	☐	☐	☐	☐

C. What are your preferred learning methods for EBM?

	Least preferred	Somewhat preferred	Most preferred	Unable to evaluate
C1 Online structured course	☐	☐	☐	☐
C2 Self-directed learning using Internet	☐	☐	☐	☐
C3 Self-directed learning using text	☐	☐	☐	☐
C4 Lecture	☐	☐	☐	☐
C5 Seminar/workshop	☐	☐	☐	☐
C6 Learning by doing on the job	☐	☐	☐	☐

D. What influence do the following factors have on your motivation to practice EBM?

	No influence	A little influence	Moderate influence	A lot of influence	Very high influence	Unable to evaluate
D1 The way I was taught EBM at medical school	☐	☐	☐	☐	☐	☐
D2 Having Internet access on the wards	☐	☐	☐	☐	☐	☐
D3 Having free access to my preferred EBM resources	☐	☐	☐	☐	☐	☐
D4 Having a clinical supervisor who practices EBM	☐	☐	☐	☐	☐	☐
D5 Desire to improve my clinical expertise	☐	☐	☐	☐	☐	☐

Other factors (please specify):

D6 _____

_____

D7 _____

_____

D8 _____

_____

E. What factors limit your current practice of EBM?

		Does not, or rarely, limits	Somewhat limits	Often limits	Always limits	Unable to evaluate
E1	My own competence/skill in practicing EBM	☐	☐	☐	☐	☐
E2	Lack of internet access on the wards	☐	☐	☐	☐	☐
E3	Not having free access to my preferred EBM resources	☐	☐	☐	☐	☐
E4	Lack of adequate time	☐	☐	☐	☐	☐
E5	Attitude of my supervisor towards EBM	☐	☐	☐	☐	☐
E6	The level of my IT (information technology) skills	☐	☐	☐	☐	☐

Other barriers (please specify)

E7 _____

_____

E8 _____

_____

E9 _____

F. How do you rate your competence in the following areas?

	Unable to perform	Limited competence	Competent	Highly competent	Expert and can teach
F1 Your overall IT skills	☐	☐	☐	☐	☐
F2 Your overall EBM skills	☐	☐	☐	☐	☐
F3 Your overall clinical competence	☐	☐	☐	☐	☐

Please make additional comments on any aspect of EBM.

Appendix B- Self-assessment questionnaire 2 (SAQ2)

A. How do you rate your confidence in the following aspects of evidence-based medicine in doing your job as an intern/RMO?

		Poor	Fair	Good	Very good	Excellent
A1	Converting the need for information (e.g about prevention, diagnosis, prognosis, therapy, causation, etc.) into an answerable question	☐	☐	☐	☐	☐
A2	Tracking down the best evidence with which to answer your question	☐	☐	☐	☐	☐
A3	Critically appraising the evidence (e.g in terms of validity, impact, and applicability)	☐	☐	☐	☐	☐
A4	Integrating this new information with what you already know (e.g your clinical expertise, patient's unique biology, values, and circumstances)	☐	☐	☐	☐	☐
A5	Changing your practice in light of the evidence you have found.	☐	☐	☐	☐	☐
A6	Evaluating the performance of your decision (e.g in terms of effectiveness and efficiency)	☐	☐	☐	☐	☐

B. *During the past 4 weeks*, how frequently did you use the following resources to help you do your job as an intern/RMO? (Please rate each one)

		more than once a day	once a day	2-5 times a week	once a week	1-3 times a month	less than once a month	never
B1	**Print/paper resources** (e.g. textbooks, journals)	☐	☐	☐	☐	☐	☐	☐
B2	**CIAP** (total usage- whether you used your assigned individual log-on details or not)	☐	☐	☐	☐	☐	☐	☐
B3	**Other internet/web-**	☐	☐	☐	☐	☐	☐	☐

	based portals (e.g. Cochrane, eMedicine, Medscape, etc)							
B4	**General search engines** (e.g. Google, Google Scholar, Scirus)	☐	☐	☐	☐	☐	☐	☐
B5	**Colleagues/peers** (e.g. fellow interns, registrars, consultants)	☐	☐	☐	☐	☐	☐	☐
B6	**Other** (please specify): _____	☐	☐	☐	☐	☐	☐	☐
B7	**Other** (please specify): _____	☐	☐	☐	☐	☐	☐	☐
B8	**Other** (please specify): _____	☐	☐	☐	☐	☐	☐	☐

C. Over the course of this study, how frequently have you been logging in with your assigned individual username and password when you use CIAP?

90-100% of the time	more than 75% of the time	more than 50% of the time	more than 25% of the time	less than 25% of the time	never	N/A (I don't use CIAP at all)
☐	☐	☐	☐	☐	☐	☐

D. During each term completed so far this year, how frequently did you use CIAP (total usage- whether you used your assigned individual log-on details or not)?

		more than once a day	once a day	2-5 times a week	once a week	1-3 times a month	less than once a month	never
D1	Term 1 (please specify): _____	☐	☐	☐	☐	☐	☐	☐
D2	Term 2 (please specify): _____	☐	☐	☐	☐	☐	☐	☐
D3	Term 3 (please specify): _____	☐	☐	☐	☐	☐	☐	☐
D4	Term 4 (please specify):	☐	☐	☐	☐	☐	☐	☐

E. How do you rate your competence in using the following databases/search engines?

	Rarely or never used	Poor	Fair	Good	Very good	Excellent
E1 PubMed	☐	☐	☐	☐	☐	☐
E2 Ovid Medline	☐	☐	☐	☐	☐	☐
E3 Cochrane library	☐	☐	☐	☐	☐	☐

	Rarely or never used	Poor	Fair	Good	Very good	Excellent
E4 Pre-appraised evidence						
E4.1 eTG (Electronic Australian Therapeutic Guidelines)	☐	☐	☐	☐	☐	☐
E4.2 BMJ Clinical Evidence	☐	☐	☐	☐	☐	☐
E4.3 UpToDate	☐	☐	☐	☐	☐	☐
E4.4 DynaMed	☐	☐	☐	☐	☐	☐
E4.5 BestBets	☐	☐	☐	☐	☐	☐

Other databases you use (please specify below):

E4.6 _____

E4.7 _____

E4.8 _____

E5 General search engines for clinical problems						
E5.1 Google	☐	☐	☐	☐	☐	☐
E5.2 Google Scholar	☐	☐	☐	☐	☐	☐
E5.3 SCIRUS	☐	☐	☐	☐	☐	☐

F. What influence do the following factors have on your motivation to practice EBM?

		No influence	A little influence	Moderate influence	A lot of influence	Very high influence	Unable to evaluate
F1	The way I was taught EBM at medical school	☐	☐	☐	☐	☐	☐
F2	Having Internet access on the wards	☐	☐	☐	☐	☐	☐
F3	Having free access to my preferred EBM resources	☐	☐	☐	☐	☐	☐
F4	Having a clinical supervisor who practices EBM	☐	☐	☐	☐	☐	☐
F5	Desire to improve my clinical expertise	☐	☐	☐	☐	☐	☐

Other factors (please specify):

F6 _____

_____

F7 _____

_____

F8 _____

_____

G. What factors limit your current practice of EBM?

		Does not, or rarely, limits	Somewhat limits	Often limits	Always limits	Unable to evaluate
G1	My own competence/skill in practicing EBM	☐	☐	☐	☐	☐
G2	Lack of internet access on the wards	☐	☐	☐	☐	☐
G3	Not having free access to my preferred	☐	☐	☐	☐	☐

EBM resources

G4	Lack of adequate time	☐	☐	☐	☐	☐
G5	Attitude of my supervisor towards EBM	☐	☐	☐	☐	☐
G6	The level of my IT (information technology) skills	☐	☐	☐	☐	☐

Other barriers (please specify)

G7 _____

_____

G8 _____

_____

G9 _____

_____

H. How do you rate your competence in the following areas?

		Unable to perform	Limited competence	Competent	Highly competent	Expert and can teach
H1	Your overall IT skills	☐	☐	☐	☐	☐
H2	Your overall EBM skills	☐	☐	☐	☐	☐
H3	Your overall clinical competence	☐	☐	☐	☐	☐

Please comment on any aspect of your experience with CIAP in relation to doing your job as an intern/RMO.

_____
_____

Appendix C- Mini-Fresno questions

CASE SCENARIO OPTIONS FOR STREAM A MINI-FRESNO:

A1
A 74-year-old woman who is otherwise well has been diagnosed with systolic hypertension (170/80 on 3 occasions over 2 months). Her GP has recommended a thiazide diuretic, but the patient is concerned about side effects and asks you whether or not medication is necessary.

P – In an elderly patient with systolic hypertension
I – how does treatment eg thiazide diuretics
C – compare with lifestyle modification in preventing
O – major cardiovascular disease

A2
A patient with a confirmed diagnosis of *Salmonella enteriditis* has had diarrhoea persisting for 5 days and asks if you can prescribe something. You consider antibiotics, but remember something about them providing no benefit and increasing the risk of becoming an asymptomatic carrier.

P – In patients with salmonella enteriditis
I – how does antibiotic treatment
C – compare to no antibiotics
O – in the duration of symptoms and development of an asymptomatic carrier state

CASE SCENARIO OPTIONS FOR STREAM B MINI-FRESNO:

B1
A 40-year-old man is diagnosed with severe community acquired pneumonia and admitted to hospital. On the 3rd day his condition is stable. The consultant decides to switch from IV antibiotics to oral antibiotics, with a plan to discharge the patient the next day if his condition remains stable. You are asked to search the literature for evidence to support the decision.

P - In patients with severe community acquired pneumonia
I - how do IV antibiotics alone
C - compared with IV switched to oral antibiotics
O - affect rates of clinical cure and length of stay in hospital

OR

B2
A 69-year-old man is admitted for elective anterior resection of a rectal cancer. His past medical history is otherwise unremarkable. In addition to calf compressors and TED stockings, your consultant recommends post-operative anticoagulation for the prevention of DVT, but you are concerned about the risk of bleeding.

P – In patients undergoing elective abdominopelvic surgery
I – what is the benefit of postoperative anticoagulation
C – compared with no anticoagulants
O – risk of post operative haemorrhage, need for transfusion, DVT, PTE, death

1. Write a focused clinical question that will help you organize a search of the clinical literature for an answer.

   (When in doubt, consider whether what is written will contribute to an optimally specific search of the clinical literature)

2. Where might clinicians go to find an answer to such a question? Name as many possible types or categories of information sources as you can. You may feel that some are better than others, but discuss as many as you can to demonstrate your awareness of the strengths and weaknesses of common information sources in clinical practice. Describe the most important advantages and disadvantages for each type of information source you list.

3. What type of study (study design) would best be able to address this question? Why?

4. If you were to search Medline for original research on this question, describe what your search strategy would be. Be as specific as you can about which topics and search categories (fields) you would search. Explain your rationale for taking this approach. Describe how you might limit your search if necessary and explain your reasoning.

5. When you find a report of original research on this question, what characteristics of the study will you consider to determine if it is relevant? Include examples. (Questions 6 and 7 will ask how to determine if the study is valid, and how important the findings are....for this question, focus on how to determine if it is really relevant to your practice.)

6. When you find a report of original research on this question, what characteristics of the study will you consider to determine if its findings are valid? Include examples (You've already addressed relevance, and question 7 will ask how to determine the importance of the findings...for this question, focus on the validity of the study).

7. When you find a report of original research on this question, what characteristics of the findings will you consider to determine their magnitude and significance? Include examples. (You've already addressed relevance and validity…for this question, focus on how to determine the size and meaning of an effect reported in the study).

Appendix D- Mini-Fresno marking rubric

1. Write a focused clinical question that will help you organize a search of the clinical literature for an answer.

FOR A1: SYSTOLIC HYPERTENSION

	Population	Intervention	Comparison	Outcome
Excellent (3 pts)	Multiple relevant descriptors *e.g., "isolated systolic hypertension," "elderly person" or "lowering blood pressure in older persons,"*	Includes specific intervention of interest *e.g. specific individual components of treatment such as "diuretic" or "beta-blocker" or combined treatments (eg diuretic plus ace inhibitor),*	Identifies specific alternative of interest since pt. doesn't want to use medication *e.g. lifestyle modification eg weight reduction, sodium restriction*	Outcome that is objective and meaningful to patient *e.g. preventing major cardiovascular disease (Stroke, MI or heart failure)*
Strong (2 pts)	One appropriate descriptor as above examples *e.g. "elderly or "hypertension"*	Mentions intervention but without specifics *e.g. hypertensive*	Mentions a specific comparison group *e.g. placebo, or "no treatment"*	Non-specific outcome *e.g. "lowers blood pressure" or "reduces side effects"*
Limited (1 point)	A single general descriptor unlikely to contribute to search *e.g. "patient"*	Mentions intervention but unlikely to contribute to search *e.g. "methods" "options" "treatments"*	Mentions comparison but unlikely to contribute to search *e.g. "compared to other methods" (Note: Using a plural non-specific term, e.g. "various treatment options," should only be counted once, in the Intervention column)*	Reference to outcome, but so general as to be unlikely to contribute to search *e.g. "effects" "change the outcome"*

Not Evident (0 pts)	None of the above present	None of the above present	None of the above present	None of the above present

FOR A2: SALMONELLA

	Population	Intervention	Comparison	Outcome
Excellent (3 pts)	Multiple relevant descriptors *e.g. Patients with salmonella infection or salmonellosis or gastroenteritis* *limit to humans* *not typhimurium* *find citing articles and review references of key articles found*	Includes specific intervention of interest *e.g. antibiotics or antimicrobial therapy*	Identifies specific alternative of interest *e.g. no antibiotics*	Outcome that is objective and meaningful to patient *e.g. carrier state or sequelae or persistence*
Strong (2 pts)	One appropriate descriptor as above examples *e.g. salmonella*	Mentions generic type of intervention *e.g. treatment*	Mentions a specific comparison group *e.g. placebo or "no treatment"*	Non-specific outcome *e.g. cure*
Limited (1 point)	A single general descriptor unlikely to contribute to search *e.g. "patient"*	Mentions intervention but unlikely to contribute to search *e.g. "methods" "options" "treatments"*	Mentions comparison but unlikely to contribute to search *e.g. "compared to other methods" (Note: Using a plural non-specific term, e.g. "various treatment options," should only be counted once, in the Intervention column)*	Reference to outcome, but so general as to be unlikely to contribute to search *e.g. "effects" "change the outcome"*
Not Evident (0 pts)	None of the above present	None of the above present	None of the above present	None of the above present

FOR B1: PNEUMONIA

	Population	Intervention	Comparison	Outcome
Excellent (3 pts)	Multiple relevant descriptors *e.g., "severe community acquired pneumonia", "community acquired pneumonia"*	Includes specific intervention of interest *e.g. specific individual treatment* *e.g." IV antibiotics"*	Identifies specific alternative of interest since pt. doesn't want to use medication *e.g specific components of comparison treatments* *IV switched to oral antibiotics*	Outcome that is objective and meaningful to patient *e.g. clinical cure / days in hospital*
Strong (2 pts)	One appropriate descriptor as above examples *e.g. "community acquired pneumonia"*	Mentions antibiotics or type of intervention *e.g. "antibiotics"*	Mentions a specific comparison intervention *e.g. placebo or "no treatment"*	Non-specific outcome e.g. cure, days in hospital
Limited (1 point)	A single general descriptor unlikely to contribute to search *e.g. "patient" or pneumonia*	Mentions intervention but unlikely to contribute to search *e.g. "methods" "options" "treatments"*	Mentions comparison but unlikely to contribute to search *e.g. "compared to other methods" (Note: Using a plural non-specific term, e.g. "various treatment options," should only be counted once, in the Intervention column)*	Reference to outcome, but so general as to be unlikely to contribute to search *e.g. "effects", "change the outcome"*
Not Evident (0 pts)	None of the above present	None of the above present	None of the above present	None of the above present

FOR B2: ANTICOAGULATION

	Population	Intervention	Comparison	Outcome
Excellent (3 pts)	Multiple relevant descriptors *e.g. pt undergoing "abdominopelvic" surgery*	Includes specific intervention of interest *e.g. heparin, warfarin*	Identifies specific alternative of interest since pt. *e.g. non-drug post-operative measures e.g. TED stockings*	Outcome that is objective and meaningful to patient *e.g. absence of deep venous thrombosis or pulmonary embolus*
Strong (2 pts)	One appropriate descriptor as above examples *e.g. pt undergoing surgery*	Mentions anticoagulation or type of intervention *e.g.anticoagulation or post-operative anticoagulation*	Mentions a specific comparison group *e.g. placebo, or no postoperative anticoagulation*	Non-specific outcome e.g. Disease oriented outcome such as circulatory complications without accompanying measure of clinical relevance *e.g. "calf pain" or "shock""*
Limited (1 point)	A single general descriptor unlikely to contribute to search *e.g. "patient"*	Mentions intervention but unlikely to contribute to search *e.g. "methods" "options" "treatments"*	Mentions comparison but unlikely to contribute to search *e.g. "compared to other methods" (Note: Using a plural non-specific term, e.g. "various treatment options," should only be counted once, in the Intervention column)*	Reference to outcome, but so general as to be unlikely to contribute to search *e.g. "effects" "change the outcome"*
Not Evident (0 pts)	None of the above present	None of the above present	None of the above present	None of the above present

2. Where might clinicians go to find an answer to such a question? Name as many possible types or categories of information sources as you can. You may feel that some are better than others, but discuss as many as you can to demonstrate your awareness of the strengths and weaknesses of common information sources in clinical practice. Describe the most important advantages and disadvantages for each type of information source you list.

	Variety of Sources	Convenience	Clinical Relevance	Validity
Excellent (6 points)	At least four types of sources listed. Types include: • electronic databases of original literature (Medline, Embase, Web of Science) • journals (JAMA, NEJM) • text book (Merck, Harrisons, monographs, ACP Medicine) • Systematic Reviews (Cochrane, BMJ Updates) • EBM publications or databases of pre-appraised information (Best Evidence, InfoRetriever, DynaMed, EBM, ACPJC, EBP, Clinical Evidence, PIER, UpToDate) • Medical website (MDConsult, PraxisMD, SumSearch) • General internet search (google, google scholar, Scirus) and Meta search (SumSearch, CIAP) • Clinical Guidelines (Health Insite,Therapeutic Guidelines) • Professional Organization (AAFP, La Leche League, NIH website)	Discussion includes at least 2 specific issues related to convenience, or mentions the same issue while discussing two different sources. Issues may include: • Cost (e.g. "free," "subscription only") • Speed (e.g. "fast," "takes time") • Ease of search (e.g. "must know how to narrow search," "easy to navigate") • Ease of use (e.g. "concise" and "NNTs already calculated") • Availability (e.g. "readily available online")	Discussion includes at least 2 specific issues related to relevance, or mentions the same issue while discussing two different sources. Issues may include: • Clinically relevant outcomes • Written for clinical application (e.g. "pertinent" "info on adverse effects" or "has patient information sheets") • Appropriate specialty focus (e.g. "directed at GPs") • Information applicable to patient in question (e.g. "can go over details of this particular patient" or "most of studies are from Europe") • Includes specific interventions in question • Specificity (overview vs. targeted) (e.g. "can get basic information" or "more specialized") • Comprehensiveness of source (likelihood of finding an answer in that source) (e.g. "she can find anything" or "contains usable references" or "not likely to have answer to this question")	Discussion includes at least 2 specific issues related to validity, or mentions the same issue while discussing two different sources. Issues may include: • Certainty of validity (e.g. quality is uncertain" or "has not been screened" or "needs to be critically appraised") • Evidence Based approach (e.g. "evidence based" or "Grade 1 Evidence" or "no references provided") • Expert bias (e.g. "usually just someone's opinion") • Systematic approach • Peer review • Ability to verify • Standard of care (e.g. "accepted in medical community") • Enough information provided to critique validity (e.g. "abstract only" or "not available full-text") • Up-to-date/outdated (e.g. "most recent research")

	• People (colleague, consultant, attending, librarian)			
Strong (4 points)	Three types of sources listed.	Includes 1 specific issue/explanation related to convenience	Includes 1 specific issue/explanation related to relevance	Includes 1 specific issue/explanation related to validity
Limited (2 points)	Two types of sources listed.	Mentions convenience involved in using one or more source, but without explanation *e.g. "convenient" or "easy" or "difficult"*	Mentions relevance of using one or more source, but without explanation *e.g. "relevant"*	Mentions validity of using one or more source, but without explanation *e.g. "good" "junk"*
Not Evident (0 pts)	No variety. Only one source listed, or all sources of same type.	No mention of convenience	No mention of relevance	No mention of validity

3. What type of study (study design) would best be able to address this question? Why?

	Study Design	Justification
Excellent (12 pts)	Names one of the best sources: • Randomized Controlled Trial or Randomized Trial • Systematic Review or Meta-Analysis of RCTS • Randomized, Double Blinded Clinical Trial	Includes well-reasoned justification that reflects understanding of the importance of randomization and/or blinding. Explicitly connects randomization to reduction of confounding and/or blinding to observer or measurement bias. *e.g. "An RCT will attempt to avoid any bias which would influence the outcome of the study through randomization" OR "best suited for therapy questions because it reduces bias and controls for confounding factors."*

Strong (9 pts)	Describes but does not call by name one of the best sources as above *e.g. "comparing two groups, one gets treatment, other gets placebo…"*	Justification is present, and touches on issues related to randomization and/or blinding, but less clearly articulated *e.g. "groups should be similar" or "try to eliminate confounding factors" or "avoid selection bias" or "to be objective" or "to eliminate bias"*
Limited (6 pts)	Describes or names a less desirable study design *e.g. "Cohort study" or "Prospective clinical trial" or meta-analysis of such studies, "longitudinal" or "prospective"*	Justification is present, and raises legitimate issues unrelated to randomization or blinding, such as cost effectiveness, ethical concerns, recall bias. May mention randomization or blinding but without explanation. (e.g. "best in a random and blind setting")
Minimal (3 pts)	Describes or names a poor study design to answer a treatment question *e.g. case control, cross sectional study, case report, "retrospective"* *Or describes a study with insufficient detail to identify a design:* *e.g. a comparative study*	Attempted justification, but arguments are non-specific and do not demonstrate understanding of the relationship between the design and various threats to validity May mention randomization or blinding but without explanation. (e.g. "best in a random and blind setting") *e.g. "to ensure quality" or "to reduce potential conflicts" or "to compare"*
Not Evident (0 pts)	None of above present	None of above present

4. If you were to search Medline for original research on this question, describe what your search strategy would be. Be as specific as you can about which topics and search categories (fields) you would search. Explain your rationale for taking this approach. Describe how you might limit your search if necessary and explain your reasoning.

	Search Terms	Tags	Delimiters
Excellent (8 pts)	3 or more terms that reflect patient, intervention, comparison, and outcome (PICO) being considered	Description of search strategy reflects understanding that articles in database are indexed by more than one field. Discusses one or more field/index/tag by name (MeSH, Title Word, Publication Title, language, Keyword, author, Journal title, etc.) and provides plausible rationale for search strategy using 1 or more of these indices *e.g. "keyword is less specific than MESH"*	Describes more than one approach to limiting search (e.g., "limit to human" or "adult" or "English"), names a specific publication type, or describes of Clinical Queries in PubMed, or the use of Boolean operators or search combinations or includes terms related to an optimal study design *(e.g. randomized) or suggests use of subheadings* ** NOTE: If the subject includes the name of the index when describing a delimiter (e.g. "check language as English") then we give credit for a tag as well as a method of delimiting.*
Strong (6 pts)	2 terms from PICO	Names 1 or more field or index category but does not provide plausible defence of search strategy based on this knowledge *e.g. "I would do a keyword search…"*	Describes only 1 common method of limiting search
Limited (3 pts)	1 term from PICO	N/A	N/A
Not evident (0 pts)	Not present	No evident understanding that articles "tagged" by different fields	No valid techniques for limiting a search listed

		or indices	

5. When you find a report of original research on this question, what characteristics of the study will you consider to determine if it is relevant? Include examples. (Questions 6 and 7 will ask how to determine if the study is valid, and how important the findings are....for this question, focus on how to determine if it is really relevant to your practice.)

Questions 5-7 address critical review of literature divided into relevance, validity, and magnitude of effect size. These may be arbitrary subdivisions of the process of critical review. Therefore respondents may describe issues of relevance in answers to any of these 3 questions. Consider the responses to all 3 questions as one response when applying the criteria in the following rubric.

	The Question	Description of Subjects
Excellent (12 points)	Well-reasoned and thoughtful discussion of the relevance of the independent and dependent variables used in the study including examples/specific reasons. May refer to: • the feasibility of the test or intervention *e.g. "the test might work but if my practice can't afford to buy the machine it doesn't matter"* • the patient or disease-oriented nature of the outcome *e.g."focused on control of BP and use of additional antihypertensives rather than on mortality and significant cardiovascular events"* • the congruence between the operational definition and the research question *e.g. "whether their method of measuring the outcome is a realistic representation of the outcome we care about"*	Includes both: • A clear expression of the importance of the link between the study subjects and target population • At least one example of a relevant disease or demographic characteristic *e.g. "were the patients similar to mine in terms of age and race?" or "was it a hospital or clinic sample like my patients?" or "did patients have same level of disease severity as my patient?" or "did selection or inappropriate inclusion criteria result in a study population that differs from mine by race, age,etc"*
Strong (9 points)	Less thoughtful discussion of the relevance of the independent and dependent variables used in the study. May include specific concepts or examples without clear rationale. May refer to: • the feasibility of the test or intervention *e.g. "is it feasible?" or "can I actually use it?"*	Includes one but not both: • A clear expression of the importance of the link between the study subjects and target population.

	• the patient or disease-oriented nature of the outcome *e.g. "look for patient-oriented outcomes" or "does the outcome matter to my patient?"* • the congruence between the operational definition and the research question *e.g. "did they measure what they set out to study?" or "how did they detect CVAs and MIs?"*	• At least one example of a relevant disease or demographic characteristic *e.g. "is the patient like mine?" or "education level of population"*
Limited (5 points)	Response implies consideration of how well the study addresses the question at hand, but offers little discussion about why this may be important *e.g. "what are the variables?"; "does it answer my question?"; "the outcome measure"; "the purpose of the study"; "will it impact my practice?"; "what type of OCP was used in the study?"; "length of follow-up"*	Response implies consideration of the study subjects, but offers no discussion of the connection between study subjects and target population or specific characteristics of the sample *e.g. "is it an appropriate sample?" or "what was the response or participation rate?" or "what were the exclusion criteria?" or "selection bias" or "setting" or "where study was conducted"*
Not Evident (0 pts)	No discussion of the research question and variables used to answer it.	No discussion of the characteristics of the research subjects.

6. When you find a report of original research on this question, what characteristics of the study will you consider to determine if its findings are valid? Include examples (You've already addressed relevance, and question 7 will ask how to determine the importance of the findings...for this question, focus on the validity of the study).

Questions 5-7 address critical review of literature divided into relevance, validity, and magnitude of effect size. These may be arbitrary subdivisions of the process of critical review. Therefore respondents may describe issues of validity in answers to any of these 3 questions. Consider the responses to all 3 questions as one response when applying the criteria in the following rubric.

	Internal Validity
Excellent (24 pts)	Lists or describes at least 5 issues important to internal validity, such as: • Appropriateness of study design • Adequacy of blinding

	• Allocation concealment • Randomization of group assignment • Invalid or biased measurement ("followed own protocol?") • Importance of comparison or control group • Intention to treat analysis • Consideration of appropriate covariates ("were other relevant factors considered?") • Conclusions consistent with evidence ("do the results make sense?") • Importance of follow-up of all study participants • Appropriate statistical analysis • Sample size / Power • Sponsorship • When study was conducted • Confirmation with other studies
Strong (18 points)	Identifies 3-4 specific issues as above.
Limited (10 pts)	Identifies 2 specific issues as above.
Minimal (5 points)	Mentions internal validity or lists one specific concept from examples above.
Not Evident (0 pts)	None of the above present

7. When you find a report of original research on this question, what characteristics of the findings will you consider to determine their magnitude and significance? Include examples. (You've already addressed relevance and validity…for this question, focus on how to determine the size and meaning of an effect reported in the study).

(Questions 5-7 address critical review of literature divided into relevance, validity, and magnitude of effect size. These may be arbitrary subdivisions of the process of critical review. Therefore respondents may describe issues of magnitude and significance in answers to any of these 3 questions. Consider the responses to all 3 questions as one response when applying the criteria in the following rubric.)

	Magnitude	Statistical Significance
Excellent (12 pts)	Response must clearly discuss both: • clinical significance *e.g. "what is the clinical significance?" or "how large a difference was found?"* • example(s) of effect size measurements *(e.g., risk difference, number needed to treat, relative risk, absolute risk reduction, mean difference for continuous outcomes)*	Well-reasoned and thoughtful discussion of the indices of statistical significance, including at least 2 specific examples of important related concepts such as: • p-values • confidence intervals • power • precision of estimates • Type 1 or Type 2 error
Strong (9 pts)	Response discusses one but not both: • clinical significance ("what is the clinical significance?" or "how large a difference was found?") • example(s) of effect size measurements (e.g., specificity, sensitivity, likelihood ratio of a test, number needed to treat, relative risk, absolute risk reduction, mean difference for continuous outcomes, positive or negative predictive value)	Lists more than one concept (as above) with insufficient or absent discussion (e.g. "p-value and confidence intervals") OR Lists and discusses only one concept (e.g. "p-value less than <.05")
Limited (5 pts)	Response only suggests consideration of clinical significance or size of effect. *(e.g. "does it matter?" "will it impact my practice")*	Mentions need to assess statistical significance or names only one concept from above without further discussion *(e.g. "p-values")*
Not Evident (0 pts)	None of the above present	None of the above present

Appendix E- Qualitative interview schedule- HEUs

Hi _____, I'm calling about the EBM Study being conducted by Sydney University that you registered for back in January. I wanted to chat briefly with you about your experience using CIAP and practicing EBM in general this year to help us understand the results we've been seeing in the study- would you have 10 minutes right now? (if not get a suitable time and date to call back).

- What's your experience with CIAP been like? What's working well? What isn't? How can the program be improved?

- In terms of your overall CIAP usage this year, what percentage of the time would you say you've been accessing it using the individual username and password we gave you?

- What other EBM resources have you been using this year (other than CIAP)?

- Has your use of CIAP varied at all over the course of this year? Based on what factors (e.g. surgical versus general medicine term, not needing it as much now as they used to because they know more)? How about with respect to other EBM resources?

- Can you walk me through what you typically do when you've got an EBM question that needs answering? How do you go about it in terms of going out and finding that information and then actually applying it?

    - What types of questions are you asking?
    - Where/what are you searching?
    - How easy is it to get the information you need?
    - Where do you do most of your searches- Work (wards? other?) Home?
    - What you got back for results- how useful was it? Did it change your practice? If so, how?
    - Does your approach vary at all? Based on what factors

Appendix F- Qualitative interview schedule- LEUs

Hi _____, I'm calling about the EBM Study being conducted by Sydney University that you registered for earlier this year. Do you have a couple of minutes for me to ask you just a few brief questions about EBM and CIAP? (If not get a suitable time and date to call back).

If they say they haven't been participating say that's exactly why you're interested in speaking to them- we want to get their perspective to help us understand we're seeing (and not seeing) in the data we've been collecting- will be really helpful to our interpretation of the results.

1. At the beginning of the study you were issued an individual CIAP username and password- we've noticed that yourself and quite a number of other participants haven't used the log-in at all and we're interested in the reasons behind this. Can you tell me what your own reasons are?

    - *We don't care that they haven't been doing it, we just want to understand why- be it because it was too inconvenient, they just weren't using CIAP at all, etc.*

2. On average, how frequently would you say you've been using CIAP this year? What are your thoughts on it?

    - *this question is about CIAP use in general/overall this year- not as it pertains to the study or logging on using the username and password we gave them*
    - *e.g. more than once a day? Once a day? 2-5 times a week? Once a week? 1-3 times a month? Less than once a month? Never?*

3. What (other) EBM resources have you been using over the course of this year?

    - *e.g. print/paper resources (e.g. textbooks, journals- any specific ones)? Colleagues (e.g. fellow interns, registrars, consultants)? Internet/web-based portals other than CIAP (e.g. Medscape, Cochrane or e-Medicine)? General search engines such as Google, Google Scholar or Scirus? Other resources?*

4. Is there anything else you want to tell us about CIAP or EBM in general in terms of your job?

    - *This is just an opportunity for them to tell us anything else they feel might be helpful to our understanding of how new doctors practice EBM, what they think about CIAP, etc.*