Evidence-based Information Seeking Skills of Young Clinicians

Rowena Cullen
School of Information Management,Victoria University of Wellington
P O Box 600, Wellington 6024, New Zealand
Rowena.cullen@vuw.ac.nz

Megan Clark
Philson Library, Faculty of Medical and Health Sciences
Symonds St, Auckland, New Zealand
mpclark@auckland.ac.nz

Rachel Esson
University Library, Victoria University of Wellington
P O Box 600, Wellington 6024, New Zealand
rachel.esson@vuw.ac.nz

Abstract

The ability of clinicians to search the medical literature, retrieve relevant research, and critically evaluate the findings and their applicability to their own practice are key skills in developing evidence–based practice in the health work force. A number of young clinicians who received training in information seeking, evaluation and evidence-based medicine during the 4th year of their medical degree at the Wellington Medical School and who are now employed as registrars and house surgeons in hospitals in Auckland and Wellington were contacted and interviewed to ascertain:

1. How much do they retain of the training undergone during their clinical training years?

2. Has the training they received had an impact on their current ability to search, retrieve and evaluate information relevant to their clinical practice?

3. What are the information seeking behaviours of these young clinicians in relation to queries that arise during clinical practice?

The findings show that although the participants recalled the training they had not retained the skills they learned during their 4th year of training, and that their information retrieval and appraisal skills were not always adequate for the clinical roles they now fill.

1. Introduction

The ability of clinicians to search the medical literature, retrieve relevant research and reviews, and critically evaluate the findings and their relevance to their own practice are key skills in developing evidence–based practice in the health work force. In 1999 staff at the Wellington Medical Library conducted a study investigating the outcomes of their instruction on Medline searching and critical appraisal given to 4th year medical students in their library [1]. The instruction was a required part of the coursework for these students, and test scores were used to assess learning outcomes of the group.

These students have since graduated and are completing their final years as house surgeons and registrars in a variety of specialty areas. In the intervening years further cohorts of medical students have received

similar training from medical library staff, with additional components being added to the training intervention by both medical faculty and library staff. As they move into roles as young clinicians, entering specialist training and general practice, a number of research questions arise:

1. How much do they retain of the basic, and any additional training undergone during their clinical years?
2. Has the training they received had an impact on their current ability to search, retrieve and evaluate information relevant to their clinical practice?
3. What are the information seeking behaviours of these young clinicians in relation to queries that arise during their clinical practice?

2. The need for training in searching and evaluating information

In the past decade the amount of clinical literature available online has increased. In the past the problem was to persuade clinicians, especially those outside medical schools and the main hospitals to make better use of services offered by medical libraries [2]. In 2002, Cullen observed the problem now is the ability of clinicians to cope with the proliferation of information available online, and develop strategies to identify and evaluate the specific information that will be useful to them in their clinical decision-making [3].

These abilities need to be developed as a routine part of medical training, and have, in recent years, become crucial to effective medical practice. As medical informaticist Barnett noted in 1995, medical students need to develop a good understanding of and have extensive experience with the use of Medline [4]. While computers make finding information faster, he argued, they can also make it more difficult. Medline today contains bibliographic citations from more that 4,600 biomedical journals and contains over 18 million citations. As Holtum [5] observes, the ability to source relevant, reliable and current information from this resource, plus the numerous other resources that have developed to specifically support clinical decision making, requires greater practice and skill, not less. In this context it is more important than ever that medical students should gain a deep understanding of database searching.

These vital skills do not, however, appear to be well mastered by clinicians. Haynes and Wilczynski [6] show that although medical literature is very accessible through online databases such as PubMed, very few clinicians are able to search them well. A study by Ely et al [7] identified some of the obstacles that prevent clinicians from answering clinical questions with evidence-based sources, of which two were: the time taken to find information and difficulties with devising the best search strategies.

2.1. Medline as part of an Evidence Based Medicine course for medical students

Many medical schools teach Medline searching as part of an Evidence Based Medicine (EBM) course with library staff offering additional sessions in searching. Holloway [8] notes a lack of student diligence and negative reactions to these parts of the EBM module, and advises that further research is needed on the issue of evaluating search assignments. West also discusses the issue of assessment tools for testing searching skills and the difficulties faced in creating assessment tasks that mirror the real world environment, stating that tasks commonly set "[do] not allow students to demonstrate their real time ability to perform EBM tasks such as generating a clinical question or searching literature databases" [9, p1059].

There is, in addition, some research looking at the ability of students to apply information they have found information to their clinical question. It is critically important that young clinicians develop competence in appraising the information they do locate and then apply the knowledge to the care of the patient before them. However, Bergus in his research on appraising and applying evidence about a diagnostic test concludes, "most of our medical students are able to critically appraise research articles about diagnostic testing but few are able to apply this information at the patient level" [10, p4]. Like Holloway [8], Bergus also identifies negative student reactions to information literacy and EBM instruction.

2.2. Are stand alone sessions effective?

The majority of the literature on Information Literacy instruction suggests that it is most effective when conducted as part of an assessed programme integrated into other learning programmes, and offered once a need has been identified. Erickson and Warner [11] conducted a study to evaluate the impact of individual stand alone one-hour Medline tutorial sessions among obstetrics and gynaecology residents and although the sessions were rated well by the participants, no improvement in search outcomes was proven. However Rosenberg's work suggests that training in formulating questions and searching databases can improve students' searching performance and the quality of evidence retrieved: "a three-hour interactive training session improved the student's ability to search databases and retrieve evidence and was well received by the students" [8, p557].

More recent studies have continued to show that training medical students to search Medline has a positive impact on their ability to locate relevant literature for clinical decision making [12,13] whether or not this is a formal part of their curriculum. Moreover, Gruppen et al found evidence that a single training session had a significant positive effect on the students' short-term EBM literature searching outcomes. However Gruppen et al also acknowledge that their study could not prove an improvement in skills beyond the four-week elective of their intervention and they suggest that "testing students again during their residencies would provide valuable information on this question" [13, p943]. Even more effective, possibly, would be training integrated into the curriculum, at a point when the skills start to be really needed.

3. The current study

The objectives of this study were to investigate whether this kind of intervention by librarians during the first year of clinical training undertaken by medical students would enhance their searching skills, provide skills useful when making clinical decisions affecting patient care, and help form the basis of life long learning. The participants in this study were students entering their 4th year of training between 1994 and 2004 in the Wellington Clinical School of the University of Otago.

From 1996 on, medical students at the Wellington Medical School have been provided with some tuition in searching, retrieving and evaluating information for clinical decision-making early in their 4th year. As part of this training they are then tested against agreed standards in the basic skills of:

- Selecting a database;
- Use of subject headings, including the use of term mapping, alternative terms and subheadings;
- Use of limits and system feature;
- Critical evaluation of the search process, the ability to refine the search and evaluate the results retrieved.

This information literacy programme was constantly being evaluated and improved upon as the Library staff developed it over the years of the study, in consultation with Medical School staff, and participants can therefore be divided by cohort depending on the type of intervention received.

3.1. The Cohort Groups:

Cohort 1: These students received no formal training in searching from Library staff as part of their undergraduate programme. (This group is used as the control group in the study reported here.)

Cohort 2: The students in this group were 4th year students over the years 1996-1998, who were given a 1 hour tutorial on searching skills during their orientation week.

Cohort 3: In 1999 the Wellington School of Medicine introduced a 4th year Health Informatics (HI) programme in which all 4th year medical students participated. This consisted of an introductory tutorial in the first week, followed by a compulsory self paced module which was assessed as part of the final mark. Cohort 3 consists of students from this class only.

Cohort 4: In 2000 the Wellington Medical School introduced an EBM programme for 4th year students. This group of students received an introductory tutorial in the first week followed by the self paced Health Informatics module and an advanced Medline tutorial introducing Clinical Queries, as part of the EBM course.

Cohort 5: In 2001 the Introductory Module was dropped from the programme, and students from 2001 to 2003 therefore participated in the HI and EBM programmes where searching skills were assessed as part of their final grade.

3.2. Method

During 2008 and 2009 the research team made contact with as many of these students as possible in order to ascertain what they recalled of their early training, and what level of skill in searching and evaluating the literature they had either retained or developed since. All those who agreed were followed up, although some were eventually unable to participate because of workload, and transfer to other hospitals. After giving informed consent, each participant was interviewed in a medical library by a senior medical librarian, with full resources available including OVID Medline as well as PubMed. Participants also had access to all the resources normally used to find information for clinical decision making. A total of 34 participants were recruited, with at least some from each of the cohorts outlined above.

Stuctured interviews and observations were conducted as outlined below, with the research team taking detailed notes. Participants were asked a series of initial questions (Q1-6) concerning: what they recalled of the Medine or information searching training sessions they had participated in during their early clinical training; what techniques they used when searching for information for clinical decision-making; which databases they normally used when searching for this information; what techniques they used to evaluate the information they found; if they had attended any continuing medical education (CME) or other sessions since graduating in which they learned more about searching or evaluating the medical literature since their basic training (including informal exchanges with peers);

Questions 7-9 focused on the participant's searching, retrieval and critical appraisal skills, e,g, how they had gone about a recent search for information, and how they rated their skills on a set of tasks: knowing which source to search; ability to identify appropriate search terms; ability to combine terms using Boolean operators; ability to limit a search using publication type, date, age categories etc; ability to use 'explode' and 'focus' appropriately; ability to critically appraise articles retrieved on the basis of patient group, intervention, comparison of outcomes, relevance of findings to patient care, etc. Each individual was asked to rate their skill level as 'None', 'Some skills', or 'Highly Skilled'.

Subsequent to this, participants were presented with a set of four scenarios and asked to conduct a search under observation. They had access to standard resources such as OVID Medline, PubMed and the usual resources available on their local intranets as well as internet access. Their search, retrieval and appraisal skills were then noted by a trained medical searcher, who noted which databases were chosen, what key concepts were identified for the search, and who rated their ability against the set of 7 skills using the same criteria, 'No skills', 'Some skills', or 'Highly Skilled'. Once the search was completed, strategies that would have been more effective were shown to participants, who were thus able to benefit from some one on one coaching, as promised in the invitation to participate.

4. Findings

4.1. Initial questions

The initial questions in the structured interviews focused on what participants recalled from the training sessions, what search techniques and what databases they currently use, and how they evaluate information they find. Responses to these questions were analysed according to the 5 cohorts in the study, and the data is presented in Tables 1-5, below.

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Table 1 - The extent to which participants in each cohort recall IL instruction givenin their 1st clinical year of training.

Cohort	Years	Number	Don't remember	Vaguely Remember	Remember
1	1995	3	1	2	3
2	1996-98	10	1	2	7
3	1999	5	0	2	3
4	2000	4	0	1	3
5	2001-4	12	0	2	10
Total		34	2	9	26

Table 2 - Strategies employed by participants in the various cohorts

Cohort	Number in cohort	Ask a librarian	Search Google	Search Journals	Use broader strategy	Go to known website
1	3	1	3	1	3	0
2	10	0	6	1	10	4
3	5	1	2	1	5	0
4	4	0	3	3	3	2
5	12	0	4	1	12	7
Total	34	2	18	7	33	13

Table 3 - Databases used by participants

Database	Number of all participants who report using	Number in pre-training cohort	Number in HI/EBM training
BestBETs*	2	0/3	0/4
Cochrane	13	3/3	2/4
Google	11	2/3	1/4
PubMed/Medline incl OVID	25	3/3	3/4
Other**	11	1/3	1/4

* BestBETs is a database of Best Evidence Topics, produced by the Manchester Royal Infirmary.
** includes MDConsult, UptoDate, NICE, various Guidelines, e-medicine, OMEN, Clin-e-Guide, EMBASE, Ballieres, e-journal web sites

The majority reported that they had reasonable recall of the sessions, but their current strategies indicated that they had broadened their search strategies beyond those formally taught. Few had returned to medical library staff for assistance since that time (see Table 2).

Participants stated that they used a range of information sources to search for information, but were generally uncertain about what constituted a database. Their responses therefore include some sources that information professionals would not necessarily call 'databases' but these have been included so as to give an accurate picture of sources used. Two key cohorts have been further analysed to identify any differences between them.

4.2. Evaluating information

While in the training sessions received by the earlier cohorts the focus of evaluation was on selecting the right database, as the evidence-based component of the training courses was developed, the focus shifted to the principles of critical appraisal based on a set of criteria, such as sample, methodology, and elimination of bias. These criteria can be described as intrinsic [2] since they assess the quality of information based on what is presented within a research or review article, compared with evaluation based on extrinsic criteria

such as publisher, journal reputation, authoritative web site etc. These distinctions have been found useful in categorising ways in which clinicians evaluate sources they use. Table 4 identifies ways in which participants in the various cohorts evaluated the items they retrieved from their searches.

Participants were also asked about their attendance at CME courses involving information literacy training or some other form of instruction that had advanced or reinforced their knowledge (see Table 5).

The final question in this section asked participants how often they consulted a librarian when looking for information.

4.3. Search skills evaluated

In their responses to Question 8 (asking participants to rate their skill level on 7 search and appraisal skills) the self-assessment of skills reported by participants varied considerably. The skills levels were scored as no skills=0, some skills=1, and highly skilled=2, giving a possible range of scores from 0-14. Individuals scored themselves from 4 through to 14, with an average score of 8. Overall participants rated their ability to search and find randomized controlled trials (RCTs) and systematic reviews highest (with an average score of 1.9), and the ability to use 'explode' and 'focus' lowest, at .68, one participant commenting they would not use such techniques since they "did not want to miss anything."

Table 4 - Criteria used for evaluating sources retrieved

Cohort	Number in cohort	Extrinsic	Intrinsic	Currency	Relevance	Other
1	3	3	3	1	1	0
2	10	8	6	3	6	4
3	5	3	3	2	2	2
4	4	3	1	0	2	1
5	12	7	5	0	5	5
Total	34	24	18	7	33	13

(Responses categorised as 'other' included "check against other sources to see if the reference makes sense', 'discuss with a colleague', 'check on the internet'.)

Table 5 - Attendance at CME or training session dedicated to IL

Cohort	Number in cohort	Yes	No
1	3	3	0
2	10	8	2
3	5	1	4
4	4	0	4
5	12	1	8
Total	34	13	18

(Yes responses include some form of instruction included in advanced papers/qualifications, specialty training, session at conference attended, journal club, or voluntary attendance at library session, rather than formal CME)

Table 6 - How often do you consult a librarian when looking for information?

Cohort	Number in cohort	Never	Rarely	Occasionally
1	3	0	3	0
2	10	3	5	2
3	5	2	2	1
4	4	1	1	2
5	12	1	5	6
Total	34	7	16	11

Table 7 - Comparisons between self-rated scores and expert evaluation

Cohort	No in cohort	Av of indiv scores across all skills in self-assessment	Av of indiv scores across all skills in expert assessment
1	3	7.6	6.0
2	10	8.4	7.4
3	5	5.8	5
4	4	8.0	5.5
5	12	8.8	6
Total	34		

In the assessment of skills in the search observed by an expert searcher, when asked to search for information to address a problem in the scenario given to them, participants scored less well. Individual scores across all 7 skills ranged from 2-13, with an average of 6.2. The highest scoring skill across all participants was 'Knowing which source to search,' and the lowest 'Able to search and find RCTs and systematic reviews,' at .33, followed by 'Able to use 'explode and focus' at .39. When the data was analysed according to cohort, differences between self-assessment and expert assessment become clear, but not differences between cohorts. See Table 7.

5. Discussion and conclusions

Although overall, 34 participants is a reasonable sample for a qualitative study, the small numbers of participants in each cohort reduce the value of the analysis by cohort, and is a limitation that should be acknowledged. . More participants are being sought to increase the ability to assess the impact of different levels of training according to each cohort. More confidence can be placed in conclusions drawn from data relating to all cohorts.

As Table 2 shows, the majority of the former students remembered the training they had received. They remembered that it occurred and sometimes remembered the content, in terms of what was covered. They might remember the terms such as 'explode', and 'subject heading' but when they came to do a search they did not recall how to apply the technique. When asked to carry out a search in response to a specific scenario almost all the former students chose to search the OVID interface, which was the interface they had been taught to use, rather than use PubMed which might have been the version available to them in their work place. Many who had not used OVID Medline since graduating felt lost, as there had been significant changes to the database's interface.

It was clear, from their responses to Questions 2-5 (see Tables 2 and 3) that participants are habitually using a wide range of information sources (in Table 2, Google, rather than Google Scholar, is a favourite, and the 'broader strategy' referred to often included Google amongst a range of other sources.) The cohort which had the most intensive evidence-based training (cohort 4) did not make greater use of evidence-based sources. Table 3 shows them to be using these less than others in the study. Nearly all the hospital clinicians in our study had access to UptoDate in their work place and this was the preferred information source for many participants in the study. Those who had stumbled across another electronic textbook Clin-e-guide found this a good starting point, in fact more useful than UptoDate. Those training for General Practice found the synthesised products their preferred starting point for patient care.

Although Table 3 shows Medline (PubMed) used by twice as many respondents as any other source, in reality, this use was infrequent. Few of the participants were searching the primary literature (via PubMed or OVID Medline) on a regular basis and therefore their skills have become poorer. The ability to search Medline for evidenced based information using the pre set filters (Clinical queries) is a skill few retained and only one had learnt it subsequently. One former student who did registrar training under the tutelage of a consultant well versed in the need for quality evidence proved the most skilful searcher, and reported that he had to use evidence-based sources on a weekly basis when presenting case histories to fellow registrars and consultants during his training. Another competent searcher had completed a Masters in Public Health and as part of that course had had further training in searching the literature for the best evidence.

Evaluation and critical appraisal skills were not well developed. Among those who critiqued the results list from their search, few were able to refine their strategies to improve the results returned. When evaluating articles retrieved, more participants relied on extrinsic than intrinsic criteria when evaluating what they found, although some were selecting items primarily on the basis of currency. Despite this, however, nearly all felt their critical appraisal skills were good and felt they were able to apply the results of their findings to patient care. This was not tested thoroughly in our study, and if Bergus [10] is correct, participants may well be overrating their skills in this area. Certainly, the quality of the searches conducted by the participants in the study raises concern that they may often be identifying relevant information and appraising and applying it from a rather inadequate list of sources. However, despite their lack of skill, this was a confident group, and not one who readily turn to medical library staff for assistance (as shown in Table 6). Few of the group had received or sought any further training in searching skills or evidence based medicine skills since graduating. What reinforcement of skills they had received came though informal channels.

In the self-assessment of their search skills, and the independent ratings given by trained searchers, the discrepancies between individuals' scores and expert scores show how wide the range of skills is in this group. Our notes on individual's searches show that participants were able to identify a suitable database, and select keywords on which to search though it is clear that in normal circumstances they would probably choose easier search options than Medline. A good proportion of the participants were able to go through to the mapping screen to choose their terms, but few recalled the concept of tree structures or sought further information about their chosen terms. A small number tried typing in whole phrases or search sentences as one might in a Google type search box. Despite not getting any results they showed little awareness of why this strategy was unsuccessful and how to improve their search strategy. There was a general lack of understanding of the power of the MeSH thesaurus, or that simple concept that typing a single search term at a time and combining the terms at the end would produce a more effective result.

In general the clinicians in this study felt confident in their abilities to search for and utilise information for patient care. However, the sources they used did not regularly include a Medline search, and many were diffident about the their ability use Medline as they remembered little about the teaching they had had and felt that this would reflect badly on them as clinicians. There was even a level of guilt expressed by some that they retained so little of the teaching. What is disappointing is that there is no clear correlation between the level and complexity of the instruction given in the 4th year of training, and the level of skill shown now. In some cases (because of testing done in the past) it was possible to identify a student who showed aptitude in searching in their training, who had continued to be a more effective searcher, and vice versa - poor search skills in the training years tended to be reflected in poor skills demonstrated in the present.

The lack of any clear evidence in the data to show the impact of more intensive and course related training in information searching, retrieval and appraisal on current skill levels suggests that acquiring these skills is a more complex matter than simple interventions in 4th year, and that there are many other factors impacting on the level of skills shown by clinicians. Anecdotal evidence gathered during this study suggests that the choice of field in which to specialize, further training in specialist courses, the influence of supervisors and instructors, and natural aptitude for searching may have more impact on the skill levels of clinicians that the training itself. This is not to suggest that this training should be in any way cut back, but perhaps repeated in later years, as the need for it becomes more urgent. In the interests of developing the future effectiveness of these young clinicians, and the well being of their patients, a collaborative team of medical librarians, senior faculty and course directors should consider how to further develop and reinforce these critical skills as young clinicians enter the workforce.

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