General practitioners’ use of online evidence during consultations

Farah Magrabi∗, Enrico W. Coiera, Johanna I. Westbrook, A. Sophie Gosling, Victor Vickland

† Centre for Health Informatics, University of New South Wales, Sydney 2052, Australia
‡ Royal Holloway, University of London, Egham Hill, Egham, Surrey TW20 OEX, UK

Received 13 April 2004; received in revised form 20 October 2004; accepted 29 October 2004

Summary

Background: Clinicians have many unanswered questions during clinical encounters which may impact on the quality and outcomes of decisions made. Provision of online evidence at the point of care is one strategy that provides clinicians with easy access to up-to-date evidence in clinical settings to support evidence-based decision-making.

Aim: To determine if and when general practitioners use an online evidence system in routine clinical practice, the type of questions for which clinicians seek evidence and the extent to which the system provides clinically useful answers.

Design of study: A prospective cohort study which involved a 4-week clinical trial of Quick Clinical, an online evidence system specifically designed around the needs of general practitioners.

Setting: Two hundred and twenty-seven clinicians who had a computer with Internet access in their consulting rooms.

Methods: Computer logs and survey analysis.

Results: One hundred and ninety-three general practitioners used the online evidence system to conduct on average 8.7 searches/month. The majority of these (81%) were conducted from consulting rooms and carried out between 9 a.m. and 7 p.m. (83%). The most frequent searches conducted related to diagnosis (40%) and treatment (35%). 83% of clinicians believed that Quick Clinical (QC) had the potential to improve patient care, and one in four users reported direct experience of improvements in care. In 73% of queries with clinician feedback participants reported that they were able to find clinically useful information during their routine work.

Conclusion: General practitioners will use an online evidence retrieval system in routine practice, and report that its use improves the quality of patient care. © 2004 Elsevier Ireland Ltd. All rights reserved.
1. Introduction

Several studies [1,2] have shown that clinicians have many unanswered questions during clinical encounters which impact on the quality and outcome of decisions made. It is estimated that medical practitioners generate between 1 and 6 questions per patient and that answers are pursued for around 30% of these [3–5]. Reasons for not pursuing information include lack of easy access to reliable, up-to-date evidence and difficulty in formulating search strategies [6–8].

Provision of online evidence at the point of care is one strategy to support evidence-based decision-making [1,7,9]. There have been few studies of the use of online evidence in routine clinical practice, but these only measure patterns of use based on clinicians’ self-reports and few report utilisation patterns for individual clinicians.

A US study examining patterns of evidence seeking of 25 clinicians in general practice identified a number barriers related to information searching including poor question formulation, limited searching expertise and skill in identifying relevant resources to obtain useful information in the context of providing care [7]. One way to improve the chance of retrieving clinically relevant information is to pre-program a search system with specialist bibliographic knowledge using programs called search filters. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.

Quick Clinical (QC) [10] is an online evidence system based upon the generic use of such filters [11–13]. Search filters are designed for typical clinical queries such as ‘diagnosis’ or ‘prescribing’ and are crafted to find evidence most likely to satisfy the query by selectively searching resources identified to be of high quality, and secondly by automatically adding specialist keywords to the general question posed by a user. For example, Medline offers a small set of ‘Clinical Queries’, which are pre-defined and validated search filters optimised to retrieve documents that are most likely to be clinically relevant, emphasising disease aetiology, diagnosis, therapy or prognosis.
An online help manual was available and help desk support was provided during the trial. Participants were asked to complete online pre- and post-trial surveys which were used to gather demographic information, and clinicians’ views about QC and evidence seeking in routine clinical work (Table 1, Table 3). In the post-trial survey clinicians were asked to rate their success in finding information. Participants were also asked to indicate whether they had direct experience of QC resulting in improved patient care.

Frequency and purpose of system use was determined from automatically generated computer logs used to record details of each search including the search filter chosen, keywords entered, data sources accessed, user IP (Internet Protocol) address, date, time and duration of searches. Clinicians were asked to identify if the IP address was their home or consulting room.

Data on the usefulness of the system was also collected via online feedback. Every day a subset of the subjects was randomly selected to provide feedback via a brief online questionnaire after every 5th search. Clinicians were asked to indicate if the information they found helped in answering their clinical question and to rate the importance of the information (Table 2). Participants were able to defer answering this questionnaire.

The study was recognised by the Royal Australian College of General Practitioners (RACGP) for its continuing medical education (CME) program. Education points were not directly linked to the number of searches performed, but to trial completion. Ethics approval for the trial was received from the University of New South Wales’s (UNSW) Human Research Ethics Committee.

### 2.3. Analysis

Keywords used in searches were abstracted from the log and categorised into subject area. Statistical analysis of data from the computer logs, online feedback and surveys was undertaken using SPSS v11.5.0 software. Descriptive statistics were used to examine patterns of use and responses to online feedback and surveys. Comparisons between groups were made using Student’s t-test, Mann–Whitney U-test and Chi Square analyses.
3. Results

A total of 384 general practitioners’ (GPs) expressed interest in participating in the trial, and 227 of these completed the registration process to commence the trial Fig. 3. Of these, 193 (85%) used QC during the trial and 159 (70%) completed both pre- and post-trial surveys. Some 34 of the 227 registrants did not use the system, and 22 of these, nevertheless, completed a post-trial questionnaire. Eighty-three percent of the 193 active participants were male and 73% were aged 35–54 years (Table 1). Seventy-six percent of active participants had 11–19 years experience in primary care. Clinicians were distributed across all six Australian States and Territories and used the online evidence system to perform 1680 searches during the 4-week study. Eighty percent of participants rated their computer skills as good or better. The total number of searches conducted by each active participant ranged from 1 to 74 (mode193 = 1, mean193 = 8.7, median193 = 5, Fig. 4), thirty used QC only once during the trial. Including the 22 subjects who did not use the system but completed a post-trial survey slightly reduced the mean number of searches per person (mean215 = 7.9 searches, median215 = 4). Use by female participants was higher compared to males (median use = 10 searches, 1—51 searches versus median use = 4 searches 1—74 searches, t = −2.916, p = 0.004).

![Fig. 3. Clinician participation in the trial of the Quick Clinical online evidence system.](image-url)
3.1.1. Will general practitioners use an online evidence system in routine care?

Analysis of the log data revealed that the system was mostly used in consulting rooms on weekdays. Of the 1293 searches where location was known, 81% (1047) were conducted in clinicians’ consulting rooms and 16% from home. The location of use was known for the searches of 151 (78%) participants. Most clinicians (80%) used QC only in their consulting rooms, 8% (12) used it exclusively outside their clinic. There was no significant difference in the mean number of searches initiated in consulting rooms or at home (mean use = 7.5 searches S.D. = 8.73 versus 8.0 searches S.D. = 10.05, t = 0.21, d.f. = 32, p = 0.42).

Overall use of the system varied by time of day (Fig. 5). Use in consulting rooms markedly increased between 9 and 10 a.m. and peaked between 3 and 4 p.m. (11%) and continued till about 2 a.m. Most consulting room use occurred between 9 a.m. and 7 p.m. (83%, 868 searches). Home use significantly increased after 7 p.m. and peaked between 11 p.m. and 12 a.m. (10%).

Use of QC varied by the day of the week (Fig. 6). On weekdays, a higher proportion of searches were initiated in consulting rooms (78%) compared to searches initiated from home (13%). Use from con-

![Fig. 4. Individual variation in QC use between 28 October to 27 November 2002 (N = 193 GPs).](image1)

![Fig. 5. Online evidence use by GPs from home and consulting rooms by the time of the day (N = 1293 searches).](image2)
Fig. 6. Online evidence use by GPs from home and consulting rooms by the day of the week (consulting room = 1049 searches, home = 208 searches).

3.1.2. Did the online evidence system provide clinically useful answers in routine care?

Participants reported on clinical usefulness in 63 searches via online feedback. For 73% of these clinicians found information that partially or completely answered their clinical question (Table 2). Clinicians reported that the majority (75%) of these searches were essential, very important or important for their patient’s care. Only 13% of searches were reported as not related to the care of a specific patient. Some responses of clinicians who did not find information to answer their clinical question are listed in Box 1.

In the post-trial survey 61% of the respondents indicated that when they used QC they were able to find the information they needed all or most of the time (Table 3). Eighty-three percent believed that QC had the potential to improve patient care and 26% reported having had direct experience of QC resulting in improved patient care. There were no significant differences between the post-trial responses of male and female participants (searching success $\chi^2 = 3.0$, d.f. = 4, $p = 0.54$; potential to improve care $\chi^2 = 1.6$, d.f. = 2, $p = 0.44$; experience of improvement $\chi^2 = 0.9$, d.f. = 1, $p = 0.77$). The respondents who experienced an improvement in patient care as a result of using online evidence were asked to specify how QC had improved care, a sample of their answers are presented in (Box 2).

Fifty-eight percent of the post-trial survey respondents agreed or strongly agreed that QC had enabled them to be more evidence-based in providing care. Clinicians who performed six or more searches were significantly more likely to report improvements in patient care ($\chi^2 = 4.8$, d.f. = 1, $p = 0.05$). These high users were also significantly more likely to report that QC had the potential to improve patient care ($\chi^2 = 10.1$, d.f. = 2, $p = 0.01$).

3.1.3. For which questions do general practitioners seek evidence?

Ninety-two percent (1549) of searches were undertaken using a profile. Of these, 40% related to diagnosis, 35% to treatment and 10% to patient education. Eight percent were related to prescribing and 7% disease etiology.

Disease specific keywords were used in a large number (1366, 81%) of searches. In comparison fewer searches involved keywords related to drugs (302, 18%) or symptoms (411, 26%). The fourth keyword ‘Other’ was utilised in 28% of the searches. The ten most frequently used keywords for each category are listed in Table 4.
Box 1: Some comments of the clinicians who were not able to find information to answer their clinical question

"Was looking for specific info on any new path tests for this (chronic fatigue syndrome) condition, maybe there aren’t any."

"Wanted to know if carbamazepine has been known to cause pancreatitis. Did not get answer."

"Triied to find whether classic CVD risk factors are important in the management of aortic stenosis. Didn’t really come near to an answer."

"Will pursue some leads from this search e.g. CDC etc."

"Looking for adverse reaction on the treatment of SVT with Verapamil IVI. Had an adverse response this am at 3:00 a.m. and wanted to review my actions."

"I sought advice on treatment for a fracture to the neck of radius. There was no satisfactory response. My guess is that this requires an orthopedic textbook. I rang a specialist."

Gastrointestinal (13%), skin (12%) and musculoskeletal (11%) were the top three disease categories followed by neurology (9%) and cardiovascular conditions (8%) (Fig. 7). Searches related to genitourinary conditions, respiratory disease and infection were present in similar proportions (6.9%–6.5%). The proportion of searches relating to women’s health, ear nose and throat, and endocrine diseases ranged from 6.0% to 5.6%. The remaining searches were related to haematology, children’s health and eyes. Fourteen percent were outside these disease areas.

4. Discussion

4.1. Main findings and implications for clinical practice

The clinical trial measured use of QC in a routine general practice setting. This is the first study to directly measure use of online evidence in a routine general practice setting. There have been a few previous studies of the use of online evidence in routine clinical practice, but these have only measured patterns of use based on clinicians’ self-reports and very few report utilisation patterns for individual clinicians [14]. The evidence system was used by 85% of clinicians in the trial and most used it more than once. QC was mostly used from consulting rooms during clinic hours. Participants reported that they were able to find clinically useful information, that QC had the potential to improve patient care, and one in four users reported direct experience of improvements in care. These findings indicate that the online model can fit into clinical practice and be used during consultation with patients.

During the trial one quarter of participants reported that they had direct experience of the system leading to an improvement in patient care. The impact of the system increased with use. Of those clinicians (n = 78) who performed 6 or more searches 50% reported improvements in patient care, a significantly greater proportion than those who performed less than 6 searches.
Box 2: Some comments of the clinicians who used Quick Clinical and experienced an improvement in patient care

<table>
<thead>
<tr>
<th>Access to information</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Able to find and demonstrate up to date information on topics, e.g. those that are controversial and those not seen very often.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Patient had symptoms suggestive of temporal arteritis - was able to correlate clinical picture with 'text book' features - thus clinched diagnosis in a potentially very serious but uncommon condition.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment and investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Able to quickly review modalities of treatment in Morton's neuroma in patient who had been told no surgical options existed. Patient awaiting surgery.&quot;</td>
</tr>
<tr>
<td>&quot;Accessing treatment guidelines.&quot;</td>
</tr>
<tr>
<td>&quot;Found investigations necessary to diagnose coeliac disease.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shared decision-making</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Found information to provide a patient regarding the diagnosis of possible polymyalgia rheumatica which increased her understanding of reasons for trial of oral steroids and made her less apprehensive of starting treatment.&quot;</td>
</tr>
<tr>
<td>&quot;Acne advice found gave patient material to make more informed choice on available therapies.&quot;</td>
</tr>
<tr>
<td>&quot;Able to get patient to accept son did not need antibiotics for viral illness, (which I had no intention of giving) and to gain their confidence in my decision making (the parent was reluctant to think my decision correct initially).&quot;</td>
</tr>
<tr>
<td>&quot;Reading up about latest developments in Myasthenia gravis, able to advise a patient who refused treatment so far and showed a possible thymoma on CT scan.&quot;</td>
</tr>
<tr>
<td>&quot;Informed discussion about OCP use in the context of a strong family history of breast cancer.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient education</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Easier to better inform patients.&quot;</td>
</tr>
<tr>
<td>&quot;Better information given to patient about their conditions.&quot;</td>
</tr>
<tr>
<td>&quot;I was able to print out information sheets on sleep hygiene for an insomniac patient which substantially reinforced our discussion on her problem.&quot;</td>
</tr>
<tr>
<td>&quot;One of my patient wanted information re hep A; she works as an EN in a nursing home. I printed out the info for her and she was able to share this with her colleagues - they all decided to get vaccinated.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Access to the information improves management, and confidence in management.&quot;</td>
</tr>
<tr>
<td>&quot;A question re appropriate investigation of a symptom and of the symptom significance was researched and allowed appropriate testing advice and reassurance of the focus patient and fortuitously another patient with the same (unusual) symptom on the next day&quot;</td>
</tr>
<tr>
<td>&quot;I had a patient with a rare disease and she had not really had a reasonable explanation from the specialist. I got both patient information and information for myself which helped both of us understand the ailment and management.&quot;</td>
</tr>
<tr>
<td>&quot;Confirmation of adequacy of melanoma follow-up.&quot;</td>
</tr>
<tr>
<td>&quot;I diagnosed a patient with thyroiditis but I decided to use QC to audit my action and after this I was less certain of my course of action and I have now referred the patient to a specialist.&quot;</td>
</tr>
</tbody>
</table>
Table 4  Top 10 categories of keywords (disease, drug, symptoms and other) used by GPs to describe their clinical questions in 1680 searches

<table>
<thead>
<tr>
<th>Disease (n = 1366)</th>
<th>Drug (n = 302)</th>
<th>Symptoms (n = 411)</th>
<th>Other (n = 466)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic fatigue syndrome</td>
<td>HRT</td>
<td>Pain</td>
<td>Child</td>
</tr>
<tr>
<td>Asthma</td>
<td>Budesonide</td>
<td>Itch</td>
<td>Adult</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Glucosamine</td>
<td>Depression</td>
<td>Treatment</td>
</tr>
<tr>
<td>Renal calculi</td>
<td>Reductil</td>
<td>Cough</td>
<td>Prophylaxis</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Paracetamol</td>
<td>Dry eyes</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Pertussis</td>
<td>Clonidine</td>
<td>Headache</td>
<td>Monocytes</td>
</tr>
<tr>
<td>Sjogren’s syndrome</td>
<td>Corticosteroids</td>
<td>Secondary amenorrhea</td>
<td>Dandruff</td>
</tr>
<tr>
<td>Tonsilitis</td>
<td>Ginseng</td>
<td>Visual disturbance</td>
<td>Diet</td>
</tr>
<tr>
<td>Tinnitus</td>
<td>Lithium</td>
<td>Irritable</td>
<td>Toe</td>
</tr>
<tr>
<td>Burns</td>
<td>Thalidomide</td>
<td>Lethargy</td>
<td>Antibiotic resistance</td>
</tr>
</tbody>
</table>

* Up to four keywords used to describe a clinical question in each search.

All the participants were new users of the QC system. The GPs we recruited were essentially unknown to the researchers prior to the study and were recruited via a call for volunteers advertised in journals, newsletters and a clinician list-server. We were able to identify five males within the sample of 193 who used the system, who were also participants in an earlier 2001 pilot study of a previous version of the system, and so these could plausibly be somehow more committed to using QC than the general population. We have run an analysis excluding these five clinicians and found no significant difference in the overall use of the system when these individuals were excluded from the analysis (mean$_{193}$ = 8.70 searches versus mean$_{188}$ = 8.68 searches).

We also found that GPs previous experience of using Medline did not influence the results. In the pre-trial survey participants were asked to nominate the three information sources they used most frequently to answer their clinical questions. 30% of these nominated Medline. We compared this group (i.e., those who reported using Medline) with the rest of the sample and found no significant difference in the overall use of QC during the trial (mean$_{Medline}$ = 7.28 searches vs...
sus mean futures = 9.17 searches, t = 1.212 d.f. = 189 p = 0.227). Therefore, participants were new users of the system and their reported prior experience with Medline did not significantly influence utilisation of QC.

Many clinicians (51%) only used QC 5 times or less during the 4-week study. Using an online evidence system once a week is plausible for a GP as it is widely reported that primary care physicians do not pursue answers to all their questions and even when questions are pursued clinicians prefer to consult a colleague for answers. A US study of information seeking in general practice found that GPs pursued answers for only 36% of their questions and online sources were used to seek information for only 2% of the questions they pursued [15].

There was a marked individual variation in use of QC (1–74 searches) when GPs were asked to use QC in their routine clinical work. The individual variation in the use of QC during the trial could be due to a number of reasons such as patient load and case mix, frequency of clinical questions, access to colleagues and other sources of clinical information and lack of time to use the system. We think that lack of experience with online systems and expertise in searching could account for some of this variation. Some GPs were not able to find information to answer their clinical question in Box 1. In the post-trial survey participants were asked to indicate the overall utility of QC to find information, 5% of the respondents reported not being able to find the information they wanted. Additionally, some GPs might have experienced difficulties in accessing QC as they might not have recorded their username and passwords for future access after their first login. Misplaced usernames and passwords were the most common reason for contacting the help desk during the trial.

Aside from technical factors we believe that organizational and social factors may have had a significant influence on online evidence use. In an investigation of the factors influencing variations in clinicians’ use of online evidence in Australian hospitals, social and cultural factors were found to be better discriminators of high and low evidence use than technical factors [16]. We will undertake further analyses to investigate if this is also the case in general practice and will report the results in a future publication.

Search profiles were the preferred strategy over searches using a single resource. This suggests that, search filters focused on clinical questions may fit more easily into clinical practice than strategies for searching by a specific resource. Clinicians used the online system to answer questions in a wide range of clinical areas. Four of the top six search categories (gastrointestinal, skin, musculoskeletal and cardiovascular) correspond to the most common reasons for an encounter with a general practitioner [17]. However, in some areas (genitourinary and neurology) greater rates of questioning in proportion to the number of clinical encounters was seen. This suggests that clinicians may have a greater demand for information in these areas.

The present study provided an opportunity to test different methods for obtaining clinicians’ views about the effectiveness of an online evidence system. Those clinicians who were requested to give feedback online directly following the completion of a search were more likely to report being able to answer their clinical questions. Seventy-three percent of respondents who completed the online feedback reported being able to partially or completely answer their clinical questions, whereas, only 44% of participants who completed the post-trial survey reported answering their clinical questions all or most of the time. Instant, online feedback obtained may be a more accurate estimate than that obtained at the end of a study because of its immediacy. However, a potential confounder was that the online feedback sampled only those participants who had completed five or more searches and this group may be more likely to perform successful searches.

The reports of participants are credible. Our previous research of hospital clinicians’ use of online evidence systems, which has included extensive qualitative and quantitative evaluation techniques indicates that clinicians are usually open in reporting when systems do not assist them in their work [18]. As shown in comments reported in Box 1 not all GPs expressed positive opinions about QC. In addition, we have recently demonstrated in an experimental setting that GPs are able to find information using an online evidence system and that this information improves their answers to specific clinical questions [19].

We used a post-trial survey and online feedback to determine the usefulness of QC. The surveys provided clinicians’ overall assessment that was also reflected back in the randomized prompted feedback which provided an overall assessment of the searches. These channels provided different information but consistent overall results. However, as highlighted above a potential confounder was that prompted online feedback sampled participants who had completed five or more searches and this group may be more likely to perform successful searches.
The aims of this formative evaluation study were to determine if and when clinicians will use online evidence in routine clinical practice, the extent to which the system provides clinically useful answers and the type of questions for which clinicians seek evidence. What we have learnt is that QC was used by 85% of clinicians in the trial and most used it more than once. QC was mostly used from consulting rooms during clinic hours. Participants reported that they were able to find clinically useful information, that QC had the potential to improve patient care, and one in four users reported direct experience of improvements in care. These results indicate that the QC model is feasible and can fit into clinical practice and will be used during consultation with patients. It shows a proof of concept and tells us that the QC system merits further evaluation to determine the extent to which access to QC can improve the effectiveness of decision-making in general practice. We are now building on these results to conduct a larger controlled study to determine the effectiveness of the QC model and the extent to which it is generalizable. It is through, such studies that we will be able to determine if certain situations are particularly amenable to the use of online evidence.

4.2. Limitations of this study

The self-selected cohort may not be fully representative of the GP population. As the study inclusion criteria was access to a computer with Internet connectivity the study sample is more likely to be representative of clinicians who are predisposed to using online evidence. In 2003, 92% of family physicians used computers in their practice, however, not all used computers for clinical purposes (prescribing 80%, medical records 61%) and only 59% percent had Internet access [17].

The participation of females in the study was below their representation in the workforce (33% female general practitioners nationally [17]). Given that we found females were likely to perform more searches than males, we believe that the study may actually be underestimating impact and that overall usage is likely to be higher with a more representative sample of GPs.

A 4-week study limits the investigation of factors which influence the diffusion and uptake of online evidence in general practice. The aim of our study was to determine the feasibility of using QC in routine general practice settings. Having demonstrated a proof of concept we are now undertaking a longer 12-month controlled study of QC which will allow us to investigate patterns of uptake, and utilization over a longer period of time and will report these results in a future publication.

4.2.1. Comparison with the existing literature

Very little comparative data are available as most other utilisation studies of online evidence are based on clinician use of Medline in the USA and Canada. Previous studies report utilisation rates ranging from 0.3 and 12.5 searches per person-month, but the denominators used in these studies only included system users [14]. QC appears to produce similar utilisation rates (8.7 searches per person-month).

A significant proportion of the searches rated by participants via the online feedback were reported as being directly related to patient care (88%). These findings are consistent with Gorman et al.’s study [16] in which they found that the urgency of a patient’s problem was one of the key factors that determined whether a clinician pursued an answer to their question.

Regarding the relevance of the information to patient care, in the online feedback 75% of respondents reported that their searches were essential, very important or important to patient care. This result is consistent with the finding that GPs are more likely to seek answers to questions they perceive to be highly relevant and urgent for their patient’s problem [20]. This is further supported by the results of an investigation into the actual uptake of online evidence in public hospitals in New South Wales, Australia which found that clinicians’ use of online evidence was strongly correlated with patient admissions [21]. Thus, given the time pressures of general practice we expect most of the questions that GPs pursue to be highly relevant and important to their patients’ care.

5. Conclusions

This study has measured individual clinicians’ use of an online evidence system in a clinical setting. General practitioners used online evidence in routine care and were able to find clinically useful information. Clinicians’ searches covered a broad spectrum of diseases including common conditions. Search profiles designed around clinical questions may be a useful strategy for retrieving online evidence at the point of care.
Acknowledgements

This research was funded by the Australian Research Council and Merck, Sharp and Dohme Ltd. The authors would like to acknowledge the assistance of Dr. Giovanna Zingarelli previously appointed at the School of Public Health and Community Medicine, UNSW, with the analysis of clinicians’ search keywords. Conflict of interest: QC was developed by researchers at the Centre for Health Informatics at UNSW, and the university and some of the authors could benefit from commercial exploitation of QC or its technologies.

References