How doctors make use of online, point-of-care clinical decision support systems: a case study of UpToDate©

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Abstract

Background: Online point-of-care evidence-based information tools are becoming increasingly popular. Objectives: To discover how doctors actually use one such tool – UpToDate – in clinical practice. Methods: An online survey was distributed to doctors at healthcare organisations in the north-west of England which subscribed to UpToDate. Some survey questions asked for quantifiable data (e.g. demographic details), whilst other questions were open-ended and sought examples of clinical scenarios and actual point-of-care use of UpToDate. Open-ended responses were then analysed into emerging themes. Results: The open-ended responses include evidence illustrating a large variety of clinical scenarios in which the use of UpToDate influenced clinical practice. Conclusions: These results show how just one point-of-care tool is used in a variety of ways that benefit the patient, the doctor and the healthcare organisation. Direct quotations reported will provide compelling evidence for librarians to present to senior managers who may be unsure of the value of point-of-care tools in clinical practice.

Keywords: education, evidence-based medicine, information seeking behaviours, information storage and retrieval, point-of-care systems, textbooks as topic

Key Messages

- Librarians need to demonstrate value for money from the electronic resources they purchase. Qualitative evidence demonstrating how staff use resources can help with this.
- Clinical staff use point-of-care online resources in a variety of ways. Disseminating instructive examples of innovative usage should improve clinical care and increase usage.
- Librarians need constantly to seize opportunities to promote online point-of-care information resources to clinical staff who may otherwise be unaware of their availability.

Background

As the use of smart phones, desktops and handheld computers becomes more prevalent, library users are making use of increasingly flexible access to medical information. Health libraries commonly report that loans of printed material are declining, whilst subscriptions to, and use of, electronic books and journals are increasing. Additionally, an ever-growing number of NHS organisations have started to subscribe to online evidence-based products, at a cost of several thousand pounds per institution per year. Such products typically synthesise information from a variety of sources, bringing together standard textbook information with summaries of the findings of the latest research.

Evidence-based products provide an appraisal of the weight of the evidence, before giving recommendations about which treatment options might be considered in particular cases. (In the case of UpToDate, the Editorial Policy section on the resource’s website gives detailed information on how evidence is obtained, graded and incorporated into the topics). The aim is to provide clinicians...
with material that can be used during clinics or on the ward, so the emphasis is on collating, evaluating and summarising high-quality evidence, rather than providing in-depth exposition. Individual topics, of which there are typically several thousand, are regularly reviewed and updated in the light of new developments.

What is already known on this topic

The recent growth of biomedical information has left clinicians suffering from information overload, often unable to sort the wheat from the chaff as the knowledge base continues to expand. Clinicians need quick and easy access to quality information resources to be able to make informed, evidence-based decisions regarding patient care. There is a wealth of literature examining why, how and where healthcare professionals search for information. Answering queries related to patient care is the main reason for conducting a literature search. Another commonly cited reason for searching is continuing professional development (CPD). Doctors cannot deliver quality medical care without regularly refreshing and enhancing their knowledge base. Clinicians often search for information to support or confirm their existing knowledge.

Electronic resources have become vital adjuncts to delivering quality patient care and can help to overcome some of the barriers commonly associated with searching for health-related information. Widely used in the clinical setting, point-of-care (POC) information tools provide a convenient reference point for clinical staff enabling access to filtered information through desktop and mobile applications. This ease of access coupled with user-friendly interfaces is undoubtedly important in their growing popularity.

Point-of-care information tools must compete with the wealth of information held on the Internet, and many valuable information resources are often overlooked in favour of more easily accessible search engines such as Google. However, it can take a considerable amount of time and skill to retrieve quality, evidence-based biomedical information from the Internet. Many studies suggest that some physicians have poor information literacy skills; therefore, POC tools need to be easy to use and efficient for clinicians to use them.

Many clinical staff lack the time to search for information, and research has shown that on average a clinician will spend approximately two minutes searching for an answer before abandoning the search. Clinicians need not have well-developed search and appraisal skills to find information using POC information tools as they provide a simple search interface, a synthesis of evidence, and links to related topics and primary research.

There is a small body of research examining the usability, impact of health outcomes and general performance of POC tools. A 2008 study showed that hospitals with access to UpToDate were reported to have better patient care quality and shorter lengths of stay. Evaluations of a range of POC information tools found no outstanding differences between the products examined.

However, there is very little research available on the type of evidence included in POC information tools. Studies that are available have examined the levels of evidence used to support the information provided by a number of POC tools, and found that there were marked differences in the currency and type of evidence used. Despite this variability in evidence, users have been found to have greater confidence in POC information tools than some Internet and evidence-based resources. It is widely agreed that more research is needed to better understand the use and impact of POC information tools in the clinical setting.

Objectives

Purchasing evidence-based information products

Where librarians are involved in making the decision to subscribe to these products, the impetus to initiate a subscription may come from library users, from librarians talking to one another, from overtures made by sales staff, or, as in the case of Pennine Acute Hospitals NHS Trust, from a decision to review its electronic resource purchasing policy brought about by increasing costs.

Library and information services vary in the decision-making process they go through in choosing an
online tool. In a rapidly changing information sector, it is vital that purchasers make informed decisions based on the quality of the evidence-based medicine (EBM) resource and preferences of their own clinical staff. In the case of Pennine Acute Hospitals NHS Trust, the library service responded to pressures to subscribe by undertaking consecutive 2-month free trials of three products: UpToDate, BestPractice and DynaMed.

A rigorous advertising campaign of the trials was undertaken by library staff. Results of the trials included clinician feedback via concurrent online surveys, allowing the results of the trials to be compared. The results showed an overwhelming preference of opinion in favour of UpToDate. Supporting evidence suggested that end users were the most appropriate staff to listen to when making purchasing decisions for point-of-care products, and a subscription to UpToDate was taken out in August 2010, to coincide with the arrival of the new cohort of junior doctors.

Value for money?

UpToDate provides subscribing institutions with statistical usage data, indicating number of topic downloads, downloads by medical speciality and most downloaded topics. This data is useful in judging whether the service is obtaining value for money from its subscription, discovering which departments are using the product and to what extent, and which departments may need encouraging to make more use of the resource. It also has some value in providing medical educators with information about topics which they might like to address in future education sessions.

What such data cannot do, however, is illustrate how clinicians actually use the information they gain from UpToDate. At a time when NHS library managers are facing increasing budgetary pressures, examples of clinical staff making practical use of expensive resources in ways that improve patient care and reduce inefficient use of resources may lend weight to arguments that senior managers wield the budgetary axe elsewhere. The results of the present study may provide evidence to library managers and others attempting to secure funding for expensive resources during these financially turbulent times.

Methods

A pilot online questionnaire was designed and a brief description of the questionnaire (see appendix questionnaire) together with a link to the online survey, hosted on SurveyMonkey, was placed on the Pennine Acute intranet in late 2010, with an invitation to all medical staff to participate. Doctors who responded were asked to state their professional grade, describe one clinical scenario in which they had used UpToDate and to suggest what they would have done had UpToDate not been available.

Analysis of the pilot study results gave rise to three further questions: respondent’s employing organisation, which information sources doctors regularly used to obtain information; and their opinions about what benefits (if any) their patients had received as a result of their use of UpToDate. Wolters-Kluwer, the European distributors of UpToDate, supplied a list of NHS trusts in the north-west of England which were current subscribers. We contacted the library managers at each of these sites with an invitation to participate in the study, and a copy of our proposed questionnaire. All twelve managers contacted agreed to participate in the study. Participating library managers forwarded an email to all medical staff within their trusts. The email contained an explanation of the purpose of the study, a link to the online questionnaire, and a statement that completing the questionnaire would be taken as giving presumed consent for anonymous responses to be included in the results.

To capture response from an informed population, we wanted to schedule the survey for a time when doctors in training would be approaching the end of their current placement and thus have had the opportunity to make use of UpToDate for several months. Accordingly, the survey was scheduled to run during the 6 weeks leading to the beginning of August when many doctors in training are scheduled to move to other hospitals. Two additional follow-up emails encouraging staff to participate were sent to the managers for forwarding at fortnightly intervals following the dispatch of the initial email.

At the conclusion of the data gathering stage of the study responses to the open-ended questions
(in which respondents were asked to describe a clinical scenario in which they had used *UpToDate*, and how they would have proceeded had *UpToDate* not been available) were matched up with each other, and classified by emerging theme.

**Results**

Demographic characteristics of respondents

A total of 299 responses were received. Respondents were asked to indicate the trusts at which they were currently employed. Table 1 indicates these responses, including those of the 21 Pennine Acute staff who took part in the pilot study.

The professional grades of the respondents showed that the majority of respondents were consultants (Fig 1). This high proportion may well reflect the relative ease of contacting consultants by email, and the comparative benefit that most consultants enjoy of being able to access their email on their own PC. Doctors in other grades frequently have to use ward PCs which might be in high demand, or else make special visits to the library to gain what in practice may be irregular access to their trust email.

From where do clinicians most commonly seek information?

When asked what sources of information they regularly consulted to find answers to clinical questions, the most common response proved to be other colleagues. It has been suggested that colleagues provide support and feedback when consulted about clinical queries, something that no database can deliver. However, as is clearly shown in Fig 2, all of the information sources we suggested as responses to this question were consulted by a majority of respondents.

Sixty respondents indicated that they were unfamiliar with *UpToDate* and thus were unable to

<table>
<thead>
<tr>
<th>Table 1 Which trust are you currently working at?</th>
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<tbody>
<tr>
<td>Trust</td>
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<tr>
<td>Salford Royal</td>
</tr>
<tr>
<td>Royal Liverpool and Broadgreen</td>
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<tr>
<td>Pennine Acute</td>
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<tr>
<td>Stockport</td>
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<tr>
<td>Royal Bolton</td>
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<td>Morecambe Bay</td>
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<tr>
<td>Blackpool</td>
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<tr>
<td>Lancashire Teaching Hospitals</td>
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<tr>
<td>Warrington &amp; Halton</td>
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<tr>
<td>Trafford</td>
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<tr>
<td>Others, not indicated, or indecipherable</td>
</tr>
</tbody>
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provide any example of how they used it. The responses of these sixty are shown in Table 2.

These replies suggest that there is still some work to be done to bring POC tools to the attention of all clinicians for whom they have been purchased.

Open-ended responses about clinicians’ use of UpToDate

We attempted to anticipate the themes of the responses that doctors might give to the open-ended questions and invited respondents to classify their response into five suggested areas. This information is shown in Fig 3. Upon reading the responses in detail, it became clear that whilst there was considerable evidence of UpToDate being used in the ways indicated, these five themes did not adequately reflect the full range of responses. In view of this, when the authors read the individual open-ended responses, they found it more appropriate to group these together into a range of themes which more accurately indicate the different ways of using UpToDate that the clinicians provided.

Sample responses typifying the themes, which we eventually agreed most helpfully reflected the range of open-ended responses, are given below. (Note that we have corrected typing mistakes, misspellings and grammatical inaccuracies, and given abbreviations in full.)

To obtain information about new treatments

Outpatient clinic today - I wanted to know if any new treatments have been recently suggested for a rare disease (patient attended the clinic as a new patient), and also I wanted to remind myself of some of the clinical features.

And

I regularly use UpToDate to make decisions on patient management, particularly when it applies to finding the most recent evidence in an area of practice where guidelines do not address. Examples of this include my recent use for the following reasons: second line therapy for sarcoidosis, duration of anticoagulation for multiple but single episode pulmonary embolisms, treatment of alevelar proteinosis.

To make correct treatment decisions

The most dramatic comment we received on this theme (or any other) was the following.

A recent situation on the Emergency Assessment Unit. I was reviewing a patient with unexplained pyrexia who was being given several different analgesics and antidepressants. I had a vague awareness that there is a condition called serotonin syndrome, but did not know much about it. I was able to use UpToDate to find the most common clinical signs (so, not just serotonin syndrome can cause x, but 15% of patients get this, 60% get this - much harder data). I was then able to make a diagnosis and start emergency treatment for a disorder which was caused by medication that he

Table 2 Responses of staff unable to provide an example of using UpToDate analysed by category

<table>
<thead>
<tr>
<th>Response</th>
<th>No. of replies</th>
</tr>
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<tbody>
<tr>
<td>Never used</td>
<td>39</td>
</tr>
<tr>
<td>N/A</td>
<td>9</td>
</tr>
<tr>
<td>Never heard of/not aware of</td>
<td>6</td>
</tr>
<tr>
<td>Not sure what it is</td>
<td>4</td>
</tr>
<tr>
<td>Rarely use</td>
<td>1</td>
</tr>
<tr>
<td>Password didn’t work</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 3 In the scenario you have described please indicate which benefit(s) your patient received as a result of your use of UpToDate
had had prescribed in this trust and which has a high mortality - I don’t think that this just speeded up diagnosis, it also helped to prevent death which would be caused by the Trust’s prescribing.

A second example shows a similar theme:

Use of nimodipine in a patient with systemic arterial hypertension. Prevented me giving intravenous instead of oral nimodipine.

And the result of giving intravenous nimodipine?

Potential harm to the patient.

(This last comment does not overstate the dangers. The UpToDate entry for nimodipine warns quite categorically, ‘Nimodipine should NOT be given intravenously; erroneous intravenous administration can result in severe hypotension, cardiac arrest, death and other heart-related complications’).

To reduce delay in starting treatment

A patient with newly diagnosed myaesthenia: prescribed intravenous immunoglobulin before neurology review.

In the absence of UpToDate, this respondent suggested that the course of action would have been:

Waited 24–48 hours for neurology review before starting treatment.

Similarly:

Management of a patient with calciphylaxis, rare but serious condition. Very good review of that condition in UpToDate and patient was managed accordingly. Good response to treatment.

Without UpToDate?

Gathering of information would have taken some time so delay in treatment.

To avoid unnecessary diagnostic tests

Case of suspected Ehlers-Danlos syndrome. Able to confirm diagnosis, review appropriate therapy, advise surgical colleagues re dangers of surgery and avoid unnecessary investigations, but perform other needed investigation.

And

Outpatients department today. Effect of the oral contraceptive pill on hypertension. Decision to manage without further investigation.

To avoid referring patients to other colleagues for a second opinion

I reviewed the current approach to possible metabolic muscle diseases in children and the possible differential diagnoses...

where without recourse to UpToDate:

...I would have needed to contact the metabolic consultant in the first case rather than being able to carry out some preliminary investigations.

To make decisions about referral for appropriate diagnostic tests

I recently used it to investigate the laboratory diagnosis of a patient (with) hypercalcaemia of malignancy and the potential usefulness of parathyroid hormone related peptide measurement. The comprehensiveness of the review made it easy for me to decide on which tests were appropriate in this patient.

A second example:

Bone marrow examination performed on one of my patients unexpectedly showed features suggestive of a lysosomal storage disorder. UpToDate improved my knowledge of these conditions and enabled me to direct further investigations in a more informed manner in order to reach a diagnosis more rapidly and more efficiently.

To reach a final diagnosis

I recently saw a patient who had sickle cell trait, was 14 weeks pregnant and had a headache present for 3 weeks. There were no clinical signs or papilloedema. I was concerned about the possibility of cerebral venous sinus thrombosis but did not have a large experience of the condition. I was able to access UpToDate immediately while the patient was still with me and read about the varied clinical manifestations of the condition. It gave me the necessary confidence to proceed with further investigation with MRI scanning of the brain.

And:

Patient with severe and life threatening hypereosinophillic vasculitis, that I assumed to be Churg-Strauss syndrome. As it turned out after reading UpToDate, numerous other differentials needed to
be entertained, some of which were potentially serious.

To reach a diagnosis faster

Saw a patient with saddle nose - looked it up on UpToDate - probably relapsing polychondritis - suggested referral to ENT for biopsy that confirmed the diagnosis.

Whereas, without UpToDate, this clinician would have:
spent ages looking through the journals.

In both examples, whilst UpToDate assisted in making the final diagnosis, we have no way of telling whether this final diagnosis was in fact correct.

To reassure the clinician that the intended course of action is appropriate

I used UpToDate recently to review current management of submassive pulmonary embolism. Using UpToDate helped consolidate my knowledge and reassure me that my clinical management was based on recent evidence base.

or:
Patient scenario requiring imaging of atypical autoimmune pancreatitis. Unusual imaging features. UpToDate literature provided relevant articles with guides to further reading, allowing confident interpretation from a position of greater knowledge, guiding further management and avoiding surgery.

As a reference tool

I use UpToDate regularly when reporting CT scans for staging information in order to give an accurate TNM tumour staging at the end of each report. This aids clinicians reading the report and in the multi-disciplinary team discussion.

We have so many different cancers to stage that it is impossible to remember the TNM staging for them all. There are some pamphlets in the department which help but these are often difficult to locate or out of date. Before I knew of UpToDate I looked on Google to try to find the appropriate website with staging information but it takes a long time to trawl through patient information websites to reach the appropriate medically oriented one.

To give immediate feedback to patients

Confirmed the diagnosis of a skin lesion and able to give patient advice without reference to specialist resources. Immediate reassurance to patient and correct management.

Or
Yesterday in clinic I saw a patient with a rare non-cardiological condition. I reviewed this on UpToDate prior to seeing her and was able to link her current condition to her cardiological problems. This saved time, made the consultation effective and gave the patient confidence in the consultation.

To avoid unnecessary consulting of senior colleagues

I needed to manage an inpatient with hyponatraemia of unknown cause. I needed to arrange the appropriate investigations, initiate treatment and check that the patient wasn’t taking any medications that I should stop. UpToDate gives structured information on the presentation, investigations, management options for most problems. It also gives the evidence to support its recommendations. In this hospital ...there is usually not an SHO/registrar on the ward from day to day and so as a ... (doctor in foundation training) it is vital that we have access to reliable information so that we can make decisions on investigating and starting treatment in a safe way without having to constantly phone seniors.

Cost-saving benefits to the organisation

A young pregnant woman had a possible pulmonary embolism. The Wells score showed moderate probability, which according to Trust guidelines means she must have radiological investigation. This was a concern, because her chest X-ray was abnormal, which means a ventilation/perfusion lung scan is unlikely to help and so she is almost certain to need a CT scan which has a very high radiation dose with risk to the fetus and also a very large risk to the patient, estimated to double
her risk of breast cancer in later life. However, looking at UpToDate revealed that a recent study has given information which allows moderate probability patients to be investigated without CT scan. UpToDate also provided the references, so I could review the original literature on this, and confirm that it is indeed safe to follow the new recommendations, so the patient did not have a scan, or a stay in hospital, and avoids the very high risk from radiation.

And the related:
Young lady with low risk pulmonary embolism. On UpToDate they describe the PERC (Pulmonary Embolus Rule out Criteria). Using this I discharged her home, no treatment required, no CT scan required, no admission required. Since finding that fact we have avoided unnecessary tests/admission in >50 patients over the last 2 years.

And:
I use UpToDate almost every day and (at) every conceivable opportunity. Recently I had a patient with lung involvement with two non-tuberculous mycobacteria (NTM), namely M. avium and M. malmoense. It was very unusual and I could not find any specific recommendation. UpToDate came to my rescue in the clinic and I could make a rational decision. It would have been extremely difficult and time-consuming (without UpToDate), having to trawl through mountains of reference journals, with possibly no consensus opinion available. I would not have been able to make a decision at the time I was seeing the patient, so another clinic appointment would have been needed.

Discussion

Limitations of the study

UpToDate is not the only POC information tool commercially available. It may well be that a similar exercise addressing users of other tools, for example, DynaMed and Best Practice, would yield similar examples of clinicians making decisions based on the evidence they provide.

The sampling method for trusts participating in the survey was based on a convenience sample using trusts in the north-west of England with an active subscription to UpToDate. We asked library managers to forward the link to the survey to all medical grades from Foundation Years 1 to Consultant. In theory, this meant the survey population would have had access to the product. Respondents, however, included a number of staff who had not used UpToDate.

In view of the comparatively low numbers of responses from doctors in training, it may be that alternative methods of questionnaire distribution to this group perhaps involving the exploitation of social media would elicit a greater response rate.

In constructing a survey instrument with a number of predetermined closed questions, respondents were guided in the responses to the question asking about their sources of clinical information. The authors felt that the options available to respondents covered the main sources identified by the current body of literature.

Respondents were asked to give an example of when they had used UpToDate to the benefit of patient care. This question did not establish the quantitative value of UpToDate in respect of how often a clinician gains knowledge that leads to a clinical benefit in terms of patient care and/or more efficient use of healthcare resources. Similarly, respondents were not asked to give comparator examples in cases where the other information sources provided similar clinical and resource benefits.

The survey also only asked respondents to give positive examples of outcomes affected by the use of UpToDate. Staff were not asked to give examples of where UpToDate was unable to provide benefit and may have wasted the time and resources of the clinician who had undertaken the query.

How applicable the quantified aspects of the study are to non-respondents is unknown. As for the open-ended responses, whilst these elicited many data-rich responses, the obligingness with which some respondents recalled anecdotes of interest makes it impossible to be certain that these examples are typical of the way UpToDate is used in clinical practice. At best, they may provide an insightful snapshot. Such is the nature of the qualitative study.

How doctors use UpToDate, John Addison et al.
As reported in our review of the literature, previous studies on POC tools have focused on accuracy and currency of content, the reluctance of clinicians to spend much time actively seeking information and quantitative evidence about measureable impact on patient care and length of in-hospital stay. In contrast, this present study takes a different approach by seeking richer data in relation to how these tools are used by clinicians.

Demographic considerations

One surprising feature of the respondents’ demographics was the high proportion of consultants compared with the relatively lower number of junior doctors. When purchasing UpToDate for Pennine Acute, we had expected that it would be of particular value to inexperienced staff working without direct supervision during unsocial hours. This may in part be due to the fact that emails inviting staff to participate in the questionnaire were circulated via institutional email accounts. As the doctors in training typically are attached to several different healthcare organisations during the course of their extended training, a large proportion of them prefer to use their permanent personal email accounts rather than regularly informing their contacts of every change in their work email addresses.

Many of the open-ended responses were extremely short, as may be expected from obliging but busy professionals completing an unsolicited questionnaire. In many cases, more detailed responses would have added to the understanding of the benefits that use of UpToDate brought to the example cited. A future study using extended interviews via focus groups in which participants could discuss examples in greater depth may uncover additional enlightening results.

Conclusions

Responses provide some evidence that all concerned in healthcare whether as commissioner, provider or consumer appear to benefit from use of UpToDate. The patient receives speedier access to diagnosis and treatment. The clinician obtains easier and quicker access to expert information to inform decision-making about patient management. (Note that both these patient and clinician benefits depend upon the accuracy of the information provided by UpToDate, something which the authors lack the knowledge or training to assess.) Finally, the healthcare organisations themselves can hope to become more cost-effective by improving patient flow through reducing unnecessary diagnostic tests and inappropriate prescribing, and speeding up time to discharge.

 Whilst the current study was confined to UpToDate, it is reasonable to suppose that doctors make use of other point-of-care online resources in similar ways. Librarians wishing to subscribe to one of these resources but who need to seek additional sources of funding may well find a judicious use of some of the quotations included here a powerful persuasive aid.

References

How doctors use UpToDate, John Addison et al.


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1 Appendix: Questionnaire

1 Please identify your professional post from the list below
   - Consultant
   - Staff grade doctor
   - Associate specialist doctor
   - Specialist trainee doctor
   - Foundation year trainee doctor
   - GP trainee
   - Nurse
   - Midwife
   - Allied health professional
   - Other

2 Which Trust are you currently working at?

3 Which sources of information do you regularly consult to answer a clinical question? (Tick as many choices as appropriate)
   - Colleagues
   - UpToDate
   - Google
   - Textbooks
   - Professional journals
   - Guidelines produced by professional bodies or employing trusts
   - Medline or PubMed

4 Please describe one occasion when you have used UpToDate in your clinical practice and how it influenced the management of your patient. (Please give as much detail as possible).

5 In the scenario you have just described what would you have done had UpToDate not been available?

6 In the scenario you have described please indicate which benefit(s) your patient received as a result of your use of UpToDate. (Please tick as many responses as you think are appropriate.)
   - Reduced delay in diagnosis
   - Reduced delay in commencing treatment
   - Avoided unnecessary diagnostic test(s)
   - Received different treatment from what would have been prescribed before use of UpToDate
   - Reduced time to discharge

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