Evidence-based medicine in practice:
A two teaching hospital organisational ethnography exploring how evidence is used in care

Bryn Lander\textsuperscript{1,2} and Ellen Balka\textsuperscript{1,2,*}

\textsuperscript{1} School of Communication, Simon Fraser University
\textsuperscript{2} Centre for Clinical Epidemiology and Evaluation, Vancouver Coastal Health Research Institute
* Corresponding Author: 702-828 West 10\textsuperscript{th} Avenue, Vancouver, BC, VSZ 1M9, ellenb@sfu.ca, +1-604-725-2756
ABSTRACT

Background: Numerous published articles show that physicians do not follow clinical practice guidelines. However, few studies explore what physicians consider evidence and how they use different forms of evidence in their care decisions. Many of the existing studies on how physicians use evidence occurred before the advent of smart phones and advanced online information retrieval technologies. It is important to understand how these new technologies influenced the ways that physicians use evidence in their practice.

Methods: In this paper, we draw on ethnographic data collected through shadowing internal medicine teams at two teaching hospitals to understand the roles that scientific evidence plays for attending physicians and trainees when caring for patients.

Results: Clinical practice guidelines represent just one of several sources of scientific evidence that are used when making care decisions. The majority of scientific evidence was accessed online, often through smart phones. Forms of evidence were used differently depending on the level of experience of the person drawing on the evidence and were often blended together to arrive at shared understandings and approaches to patient care. In applying evidence to care, internal medicine team members are cognizant that scientific evidence is evolving, occasionally of low quality, can make competing claims, and does not cover all clinical problems. In moving from incorporating summaries of scientific evidence to primary sources of scientific evidence into their care decisions, trainees and attending clinicians increasingly add scientific uncertainty to the medical uncertainty that is inherent in their practice.

Conclusions: This paper outlines one way that the ethos of evidence-based medicine has been incorporated into the daily work of care. Here multiple online forms of evidence
were mixed with other information. This is different from the pathway that is often articulated by health administrators and policy makers whereby clinical practice guideline adherence is equated with practicing evidence-based medicine.

**Keywords:** practice guidelines; evidence-based medicine; mindlines; ethnography

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**Evidence-based medicine in practice**

**Background**

Clinical Practice Guidelines (CPGs) have become ubiquitous, provide concrete practice recommendations for care providers, and are often viewed as an integral component of evidence-based medicine [1–3]. Figure 1 shows an idealized evidence-based medicine hierarchy whereby research is appraised, compared, consolidated, and rewritten into CPGs. Despite the significant resources now devoted to producing, adapting, and implementing CPGs, as highlighted by Eby [4] and others [5], CPG adoption in practice has been problematic. Several reviews of existing studies concerned with the under-utilization of CPGs focus on barriers to CPG adoption [6–9]. These studies assume that increased CPG uptake leads to more evidence-based care [10]. Few, if any, of these studies consider how information is accessed in the day-to-day work of clinicians.
Gabbay and le May’s ethnographies [11,12] explored how clinicians use research in their day-to-day work. They argue general practitioners “normally found [it] neither necessary nor helpful to refer to guidelines or other sources of evidence directly during their day-to-day practice.” [11] Clinicians draw instead on mindlines, “collectively reinforced, internalised tacit guidelines” [12] developed through interactions with healthcare professionals and patients, personal medical training, experience, and context. This mindlines research was nominated as one of 20 influential BMJ papers over the last 20 years [13]. Wieringa and Greenhalgh [10] found in a systematic review of ‘mindline(s)’ conducted ten years after the publication that few studies empirically explored mindlines. They argued key components of mindlines—such as knowledge co-construction and shared sense-making—need further research. Mindlines are formed in teaching hospitals as trainees learn how to think like doctors [11]. Through interviews, Timmermans and Angell [14] found that
residents consult an array of evidence including MD Consult, “cheat” books, textbooks, CPGs, review articles, and primary research articles.

The works of Gabbay and le May [11,12] and Timmermans and Angell [14] occurred before smart phones and advanced online systems made exponentially increased accessibility of information. More recent studies assessed the impact of smart phones and information retrieval technologies on primary care clinicians [15,16] and internal medicine residents [17] arguing these technologies increase the degree and variety of evidence accessed by clinicians. Others have assessed how virtual networks of physicians inform the development of mindlines [18]. None of these studies observed how clinicians used scientific evidence in their daily work. This paper explores the ways that scientific evidence is used in the context of everyday practice and how physicians and trainees draw on a multiplicity of knowledge in their decision-making processes in the age of smart phones and online information systems.

**Methods**

This paper is based on an integrated knowledge translation project [19]. Hospital practitioners and administrators formed a project advisory committee that took part in research design, advised during data collection and analysis, and acted on project findings. The project focused on a problem identified by a health administrator to better understand why their doctors did not follow CPGs. We used an ethnographic approach to study how evidence—including CPGs—was used in Internal Medicine care at two teaching hospitals (identified as ‘Hospital A’ and ‘Hospital B’). Multiple methods were employed, including ethnographic shadowing of care workers, in-situ interviewing, and patient chart audits (reported elsewhere). This study received ethics approval from the
Research Ethics Boards at the University of British Columbia (CREB#H15-0118) and Simon Fraser University (REB#2015s0388). Both Hospitals A and B granted organisational approval for this project. Informed consent was obtained from all participants directly shadowed and/or interviewed for this project.

Internal Medicine at both hospitals is called the Clinical Teaching Unit (CTU) because it is actively involved in training residents and medical students. Care is provided through teams comprised of an attending clinician (attending), a senior resident (in their second or third year), 2-3 junior residents (in their first year), and 2-4 medical students. We refer to both residents and medical students as ‘trainees’ unless a sub-group is identified. The team’s senior resident and attending manage the rest of the team and oversee care.

One of this paper’s authors, [initials blinded], shadowed care providers. Shadowing involves following and observing participants during their normal work and asking them — during lull periods — to interpret actions through informal interviews [20,21]. Shadowing CTU team members occurred between October 2015 and January 2016 and alternated every four weeks between the two hospitals. Patients are predominately admitted to the CTU from the Emergency Department (ED). [initials blinded] began by shadowing CTU team members involved in ED patient assessments and admissions. [initials blinded] then shadowed CTU team members on the hospital wards. Shadowing occurred in 4-hour blocks to observe work processes unfolding while maintaining field note quality. Shadowing was supplemented by a small number of observations of formal teaching during an annual orientation for new CTU junior residents. In total, 35 CTU team members consented to be shadowed or interviewed for the project. Many more CTU
team members that were incidentally encountered during shadowing were recorded in field notes. Table 1 outlines data collected at Hospitals A and B by data type, hours, location, and number of shifts. In total [initials blinded] collected 168 hours of data.

<table>
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<th></th>
<th>Hosp. A Hrs. (# shifts)</th>
<th>Hosp. B Hrs. (# shifts)</th>
<th>Total Hrs. (# shifts)</th>
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<td>93:43(21)</td>
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<td><strong>Total</strong></td>
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<td><strong>101:13(29)</strong></td>
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Table 1: Internal medicine team\(^a\) data collection in Hospitals A and B by type, hours, and number of shifts

Field notes were transcribed into more complete computer typed notes at the earliest possible opportunity and imported into NVivo (qualitative data analysis software). [initials blinded] coded field notes and wrote related memos. Analysis of data began during the data collection. Preliminary findings were outlined and presented to the project’s advisory committee at regular intervals for feedback. Emergent findings were also discussed with informants as a form of “member check” [22]. All names used here are pseudonyms. Field note excerpts refer to the field note number followed by the line number where each excerpt begins (i.e. 0116:23).

Results

Types of Scientific Evidence Consulted in the CTU

Hospital care in the CTU represents a complex, dynamic, and fast-paced environment. Attendings, residents, and medical students rotate between specialties and hospitals. Rotations range from 1-6 weeks, leading to high turnover as teams of workers are
constantly being formed and re-formed. Within this environment we observed CPGs as one of multiple evidence sources that influenced patient care and teaching. Other evidence included peer reviewed articles (predominately clinical trials published in high impact journals), UpToDate and Lexi-Interact, Google, Pocket Medicine, and phone applications. We classified experience as an additional type of evidence. We recognise that experience is often shaped by evidence. Several existing studies, including the mindlines work of Gabbay and le May, argued that clinicians predominately drew on experience not evidence in their work [2,11,23]. We wanted to compare our findings to these studies.

UpToDate and Lexi-Interact are provided by the same private company on a subscription basis and can be accessed through computers or smart phones. UpToDate is “an evidence-based, physician-authored clinical decision support service.” Its website is searchable with over 10,500 topic reviews that are constantly being updated. Entries range from 10-40 pages and include overviews of conditions and recommendations for treatment. Entries synthesize and explicitly reference a variety of evidence including CPGs, clinical trials, and meta-analyses. Lexi-Interact is a drug database that identifies possible interactions—and its risk rating—between drugs and recommends responses to interactions. The following field note excerpt illustrates how UpToDate and Lexi-Interact are used:

Matt [attending] is reviewing a patient admission with a resident. He asks the resident if he has checked the drugs for the patient related to their kidney transplant. The resident shakes his head and Matt tells him to use UpToDate and that he’s “checking on my phone.” The resident asks Matt “what are you looking for?” Matt tells the resident to punch all of the drugs that the patient is taking into Lexi-Interact and adds that you need to remember that with transplant
patients some drugs are super dirty and you have to check for interactions.

(1007:306)

Here Matt—an attending physician—models for a resident how to use an existing online information system to inform prescription choices for a complex patient.

Pocket Medicine [24] is a book designed to fit in the pocket of a physician's white coat. Through bulleted lists, tables, and algorithms it provides diagnosis and treatment suggestions for the most common disorders in internal medicine:

Nate [senior resident] is writing in a history sheet about a patient that he is assessing for admission. He keeps on looking at his phone and [initials blinded] asks him what he is looking at. He tells [initials blinded] that he has a book called Pocket Medicine and that he took pictures of the different pages and put the pictures into his phone. Nate shows [initials blinded] the photographed pages on his phone. [initials blinded] can make out his own penciled notes on the book’s pages in the photograph. Nate tells [initials blinded] that he used to carry the book around with him but decided that it was easier to take pictures of the different pages. Right now he’s looking at the book’s heart failure section and reviewing the book’s recommendations for how to treat heart failure patients.

(1016:233)

Both Matt and Nate rely on their personal smart phones to search for scientific evidence to solve clinical problems encountered in their practice. While Matt relies on a specialised application, Nate has adapted a physical book to an electronic form for ease of transport.²

We found that scientific evidence was used differently in teaching and care and, within care, varied by role. Figure 2 outlines the proportion of evidence consulted in trainee teaching and patient care by evidence type. In addition to formal CTU orientation, teaching is incorporated into the CTU workdays both formally—through morning, lunch, and afternoon lectures—and informally through discussions between CTU team members. We classified informal discussions as teaching or care depending on whether a
reference was made to the care plan of a specific patient (care) or care approaches more generally (teaching).

Using Teaching to Model Good Evidence Use

Figure 2 shows that peer reviewed articles and experience played an important role in teaching while UpToDate played an important role in care. Teaching sessions often began with the introduction of a patient case followed by a discussion of evidence that was used to formulate a care plan for the patient.

*Teal [senior resident] is teaching to a room of trainees. She begins by presenting a case where a pregnant woman has a fever, feels dizzy, falls over, and gets admitted to hospital. Over the next half hour, Teal [with input from the residents in the audience] writes out a strategy to initially manage, diagnose, and treat the patient for sepsis. One of the treatment strategies for sepsis is to give patients IV fluids. Teal tells the room that this patient got 2 liters of normal saline solution and asks the audience if that's a good amount to give or if they think the patient should get more or less. She continues, saying that "I want to challenge" the amount of fluids given to a septic patient. "We were all taught the Rivers*
Protocol."[25] Teal adds "The new approach is to give" a certain amount of fluids" and then reassess. We were all taught to keep on giving fluids but that is now changing because fluids given above a certain point may be associated with increased mortality." Teal compares these recommendations to the UK sepsis guidelines for pregnant women and mentions that she couldn’t find any equivalent Canadian guidelines. She reminds the room of the mantra “healthy mommy is healthy baby” and that in these types of situations the focus should be on caring for the mother not the baby. (1028:30-174)

Teal uses this session to model evidence use predominately drawing from peer reviewed articles and clinical practice guidelines. Even though the trainees in the audience graduated from medical school within three years, Teal tells them their knowledge is out of date because scientific evidence has evolved. In another teaching session about sepsis, a Fellow (completing additional training after his residency) discusses the peer reviewed articles supporting the new sepsis approach and rhetorically asks the room if new evidence means the Rivers dogma is broken. A Resident asks “what protocol do we follow” if we had a septic patient? The Fellow leaves this question unanswered (0721:187-466). Here scientific knowledge related to sepsis care has evolved but implications to daily clinical practice are not apparent. By incorporating up-to-date scientific evidence into care, clinicians contend with scientific uncertainty in addition to medical uncertainty in their work [14].

In formal teaching, experience was often used to fill in holes and cover grey areas identified in scientific evidence. These were cases where “there are no clear guidelines, it’s a clinical decision,” (Nicola, attending, 0107:148), where treatments have been used for 100 years and they work so we use them (Ray, attending, 0719:151) and where a treatment “is empiric, based on what people do not based on a clinical trial." (Adam, senior resident, 0219:65).
Consulting Evidence and Mindlines in Patient Care

Trainees gathered multiple kinds of information to develop a narrative of patient diagnosis and care that was presented to an attending. This formal presentation was used by attendings to review care plans and lab and imaging results, test trainees’ knowledge and reasoning processes, and to engage in teaching moments relevant to diagnosis and care. How scientific evidence was incorporated into this narrative varied by evidence type. Some types of evidence were predominately invoked while others were read.

Experience was always invoked. CTU team members predominately invoked, rather than read, peer reviewed articles. The exception was one senior resident who was observed skimming a peer reviewed article while formulating a patient’s care plan.

Nick [attending], Mel [senior resident], and Neil [medical student] are at a nursing station discussing a patient under Neil’s care who is about to start chemotherapy. They try and remember the name of the drug that the patient might have to take as part of this therapy. The drug’s name starts with R. Nick comments that the drug has a potentially fatal side effect. He talks about the craziest case that he saw when a patient took the drug as part of their chemo and crashed as a result. Mel replies that the worst case that she saw was with a 17-year-old boy and he ended up dying. Turning to Neil, Nick tells him that the side effect is treatable but the first few days can be sketchy. He advises Neil to “think of the 5Hs and Ts [a mnemonic that is part of the advanced cardiac life support guidelines used to aid in remembering possible causes of cardiac arrest[26,27]] when you see [the patient].” (1210:496)

Sara [attending] is reviewing a patient admission with Phil [medical student] in the ED. The rest of Sara's CTU team listens. The patient in question is an elderly man who is being admitted due to delirium and a fall. Phil begins to summarise the patient’s history and provisional diagnosis, listing delirium as the patient’s primary issue. He then begins to outline possible causes for the delirium using the DIMS mnemonic [drugs, infections, metabolic and structural, a mnemonic commonly used to treat delirious patients with no explicit grounding in research or guidelines].[28] Sara tells the team that “mine is DIMS UFO where U is urine, F is fecal, and O is more involved. We will go over it this afternoon during teaching but the U is based on a paper by [Sara gives the author's name] who is the Godmother of delirium.” (1215:89)
Like Matt above, in these two examples, attendings Nick and Sara talk with trainees in a process of knowledge co-construction and shared sensemaking[10] to determine an appropriate approach to caring for their patients. Unlike Matt, Nick and Sara do not refer to information technology to help them formulate care plans. Instead, they attempt to verbally make explicit their tacit thought processes and the information that is incorporated into their own mindlines [11]. In their mindlines, different kinds of potentially relevant information are combined [10] including personal experience, context, clinical practice guidelines, and peer reviewed articles.

In addition to drawing on their mindlines, CTU team members explicitly searched for and read evidence in UpToDate, Lexi-Interact, Pocket Medicine, and phone applications. Attendings would read from these sources during conversations with trainees. Most often these would be simple searches in Lexi-Interact used to double check medication dosing or potential interactions between different medications (as described in the Matt example given in the “Types of Evidence” section above). On other occasions, attendings would read evidence in order to double check their own inferences and supplement gaps in their own knowledge. Trainees explicitly searched and read these sources of evidence to help them develop care plans:

Fred [senior resident] stands outside of a patient's [P2] room. Kate [medical student] comes out of P2's room...Kate tells Fred that P2 grew e. coli in his nephrostomy tube [like a catheter but inserted directly into the kidney] and she thinks that they should prescribe antibiotics. Kate adds that she isn't sure which antibiotics to prescribe...Fred goes to UpToDate and types in the search terms 'nephrostomy UTI' and then scans the first UpToDate document that comes up. He goes to the health authority's formulary site and looks for antibiotics for catheter associated infection and skims the article and reads a section out loud to Kate saying 'do not treat positive cultures without symptoms.' Fred asks Kate if she has heard of CAUTI [catheter associated urinary tract infection] and searches for, then shows Kate, a page on UpToDate about the condition. Fred
adds that he’s not sure if the same approach would apply to a nephrostomy infection. Fred then Googles nephrostomy and infection and finds an article by the Infectious Diseases Society of America about nephrostomy and infection. Kate smiles at Fred and tells him that she likes that organisation. They skim the article together but it has no recommendations about what they should do if they get a positive culture. Kate takes her IPad out and begins to search for information as well. She finds another entry in UpToDate that says that cultures in asymptomatic patients shouldn’t be treated but that the tube should be changed as soon as possible. Fred looks at P2’s lab results. P2 has no white blood count and he is afebrile. Kate adds that she worries about P2 because he is immunocompromised…Fred decides that they won’t treat for the positive culture but that they might try and get P2’s tube changed. (0105:431)

In this case, Fred and Kate together sift through various potentially relevant forms of information and personal knowledge to together make sense of a clinical problem and develop a care plan. Fred draws from his own knowledge of how to treat catheter associated urinary tract infections but he is unsure if nephrostomy associated infections are similar enough for his knowledge to be applicable. Both Fred and Kate read to supplement what they know, using computers and iPads to access online information. The information selected for reading is not peer reviewed articles (as modeled during teaching) but are summaries with concrete recommendations. Multiple online sources are consulted. These are not read in any depth but are skimmed for relevant information. Through discussions Fred and Kate combine knowledge extracted from summary documents, their nascent mindlines, patient lab results, and their knowledge of the patient to form a provisional care plan for P2.

CPGs were both invoked and read, depending on the person and the situation. In one case, two patients were admitted to the CTU for carbon monoxide poisoning. Still in the ED, the patients were scheduled for three hyperbaric dives [where they would be placed in a chamber with high pressured oxygen to reduce the amount of carbon monoxide in their blood]. Matt [attending] tells [initials blinded] that he believes the carbon monoxide
level in both patients is already quite low and he isn’t sure if the dives are necessary. At
the ED nursing station Matt greets an older ED doctor who oversees the hyperbaric
chamber. Matt asks the ED doctor if the hyperbaric dives are necessary. He explains that
the patients’ carbon monoxide levels are already quite low and asks “how much does it
help at this point?” The ED doctor answers that current best practice says to do the three
dives and that “there is absolutely no evidence but it is standard of care so we’ll do it.
We’ll do three. They’ll get the benefits that they’ll get…the literature is unclear, no
consistent evidence of benefit.” (1023:372) Here Matt and an ED doctor together make
sense of an appropriate treatment plan for two patients. Matt questions the agreed upon
approach, citing specific lab results for these two patients. The ED doctor invokes ‘best
practice’ to justify his own mindline for treating carbon monoxide poisoning. Here ‘best
practice’ is not viewed as evidence-based. Rather the ED doctor
believes that following
best practice is a prudent approach in the absence of clear evidence.

In other situations, trainees read CPGs to help inform care decisions. Above, local
guidelines are one of several online evidence sources used by Fred and Kate to formulate
a care plan for P2. Local guidelines recommending antibiotic prescription were read in
another instance as two residents discussed which antibiotics to prescribe to a septic
patient in the ED (1029:773). On another occasion in the ED, Rick [senior resident] read
CPGs found through Google as well as UpToDate to check the NAC 72-hour protocol.
This protocol is used when a drug (N-acetylcysteine) is administered over 72 hours to a
patient who has overdosed on acetaminophen (1026:330). In a final case, guidelines were
read not to guide care decisions but to help structure summaries of care. Fred [senior
resident] sent the medical students on his team guidelines written by a medical
association outlining the key sections to be covered when dictating discharge summaries describing a patient’s hospital stay after discharge (0105:257).

Figure 3 looks at the care column in Figure 2 in more detail, subdividing type of evidence consulted by the role of the CTU team member (attending, senior resident, junior resident, or medical student). Figure 3 shows that individuals in all roles read UpToDate. It also outlines how care providers in different roles consult evidence types differently. Medical students and junior residents predominately read summary sources—such as UpToDate, Lexi-interact, Pocket Medicine, and Phone Apps—of evidence. Conversely, attending physicians consulted UpToDate and Lexi-Interact almost a third of the time but invoked their own experience or knowledge of peer reviewed articles 60% of the time. Senior residents consulted the widest variety of evidence sources drawing on
summary sources (particularly UpToDate) but also invoking peer reviewed articles and experience when making their care decisions.

**Discussion**

The changes in evidence use by role presented in Figure 3 are intuitively appealing as trainees begin to incorporate clinical approaches to common medical problems and their own experiences into their mindlines. Because attending physicians have worked as clinicians longer, they have had more time to read pre-existing peer reviewed articles, may be more able to stay abreast of new literature, and have a larger number of clinical experiences to draw on. An alternative explanation is that Figure 3 simply shows a cohort effect whereby trainees are more comfortable with accessing online information systems and using smart phones. While a cohort effect may explain some of the observed variance, it does not explain differences in how senior and junior residents (separated by a year) consult evidence. Comparing Figures 2 and 3 we also see that as CTU team members become more senior the forms of evidence they use in their care increasingly approximates the types of evidence use modeled during formal teaching.

In 1961, Becker et. al. [23] reported instances where experience was invoked to overrule scientifically verified knowledge—a phenomenon we did not observe. Although Gabbay and Le May [11] state that they rarely observed care providers reading summary evidence to inform their daily practice, we observed this practice across all groups. These three studies may represent different stages in the institutionalisation of the evidence-based medicine paradigm into clinical practice representing pre [23], early [11], and later (seen here) stages. Our observations may also be a result of the increasing codification of evidence in commercially produced applications and other tools and their ease of access.
on smart phones and computers. Gabbay and le May[11] note that by the end of their observations physicians were consulting evidence more frequently. Many of the clinicians observed by Gabbay and le May [11] trained before 1990, when evidence-based medicine was introduced as part of medical school training, whereas our study occurred in teaching hospitals where evidence-based medicine is emphasized. Gabbay and le May [11] do note that UpToDate was referred to as a ‘bible’ during their observations in a teaching hospital’s internal medicine specialty.

In incorporating scientific evidence with other potentially relevant knowledge, attendings and trainees were cognizant that existing evidence is constantly evolving, occasionally of low quality, can make competing claims and may not cover a specific clinical problem. More senior CTU team members may be more comfortable negotiating this scientific uncertainty while more junior members—as shown in the sepsis example—may simply want a protocol that they can follow when caring for their patients. It was widely recognised that clinical and scientific uncertainty often remained despite referring to a broad array of evidence and information and that clinicians may ultimately make choices based on their interpretation of this uncertainty in the context of a specific patient’s care needs, which is consistent with the mindlines concept.

In our study multiple forms of online evidence were accessed—often through smart phones—and mixed with other forms of information. Our research suggests that evidence-based medicine has been incorporated into the daily work practices of the CTU teams studied here, just not in the ways envisioned by health administrators and policy makers. This view echoes Gabbay and le May[11] who found that “practitioners had their own hierarchy of evidence that is different from that usually promulgated by the EBP
[evidence-based practice] movement.” Instead of drawing on CPGs, CTU teams invoke and read a variety of different evidence sources, blending them together to arrive at shared understandings of patient care. This collective blurring between creating and applying knowledge to clinical problems has been found by others.[18] Senior team members model evidence use whereby mindlines drawing on peer review articles and personal experience are combined with reading UpToDate to inform care decisions. CPGs play a lesser role.

**Conclusion**

This paper—part of a larger study concerned with factors contributing to the use or non-use of CPGs—explores the multiplicity of knowledge that is combined by clinicians in decision-making processes within teaching hospitals. It has responded to calls for more empirical work exploring the complex ways that evidence and mindlines are incorporated into teaching and care [4,10]. CPGs were used by CTU team members but only as one of several sources of evidence that were read and invoked within the CTU. These forms of evidence were used differently in teaching and in care and—within care—depending on the level of experience of the person drawing on the evidence. This study shows how mindlines are enacted [10–12] as clinicians blend multiple forms of evidence together to arrive at shared understandings and approaches to patient care. It also outlines how types of evidence consulted in care varies depending on CTU team role.

Despite recent attempts of the evidence-based medicine movement to broaden its parameters to include multiple forms of evidence and context, health administrators frequently equate low CPG uptake and a lack of standardisation with not practicing evidence-based medicine. Our findings suggest that health administrators, policy makers,
and the evidence-based medicine movement need to expand how they support and assess clinicians’ use of evidence to better reflect this work process. It is unclear if these work practices have diffused into community-based hospitals and general practices. In these other settings, CPGs and other tools such as order sets may be more effective vehicles to incorporate evidence into practice. As physicians increasingly rely on their smart phones to access information, health administrators and policy makers will decreasingly be able to control the type and quality of information they access. It is important that these players understand current use patterns to support the application of quality evidence into clinical practice decisions.

UpToDate, Lexi-Interact, and Pocket Medicine are all published by the same private company. Combined, they represent over half of the evidence we observed being consulted. An avenue of future research is to compare the recommendations provided by UpToDate to other sources of evidence to better understand if UpToDate may be creating any biases of how medicine is practiced.

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**Conflicts of interest**

The authors have no conflicts of interest to declare.
Endnotes


2. BL often asked CTU team members what they were doing on their phones but, out of respect for their privacy, BL tried not to peek into their personal phone activity unless invited to do so. Thus, references to phone applications often went unobserved.
References


