UpToDate®

Use of Evidence-based
Resources by Clinicians
Improves Patient Outcomes

Wolters Kluwer
Health

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Table of Contents

Introduction

The biomedical knowledge base doubles about every 19 years, resulting in a fourfold increase of medical knowledge during a physician's lifetime [1]. Surveys of physicians as early as 1989 identified the large volume of literature to be problematic; two-thirds of the 625 physicians in office-based practices, and 100 physician opinion leaders, stated that the volume of medical literature was "unmanageable" [2].

The problem is getting worse. Only 39 randomized controlled trials (considered to be the gold standard for clinical trial design) were published in 1965, compared with more than 26,000 in 2008 [3]. This represents an approximate doubling every ten years, suggesting that there will be more than 50,000 randomized controlled trials published annually by 2019.

Optimal medical care requires that clinicians apply the best available evidence to clinical decision making. Thus, the inability to keep up with evolving medical knowledge has potentially serious implications on quality of care. This review will consider the scope of the problem and discuss possible solutions that can make the volume of literature manageable and improve patient outcomes.

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Quality of Care Declines as Physicians Are Further Out of Training

Several studies have demonstrated that a physician's knowledge base decreases with time. An illustrative study included 289 internal medicine generalists and specialists who had received board certification from the American Board of Internal Medicine (ABIM) within the previous five to 15 years and were given an 82-question multiple-choice examination [3]. Knowledge declined over time, with a significant inverse correlation between examination scores and the number of years elapsed since ABIM certification.
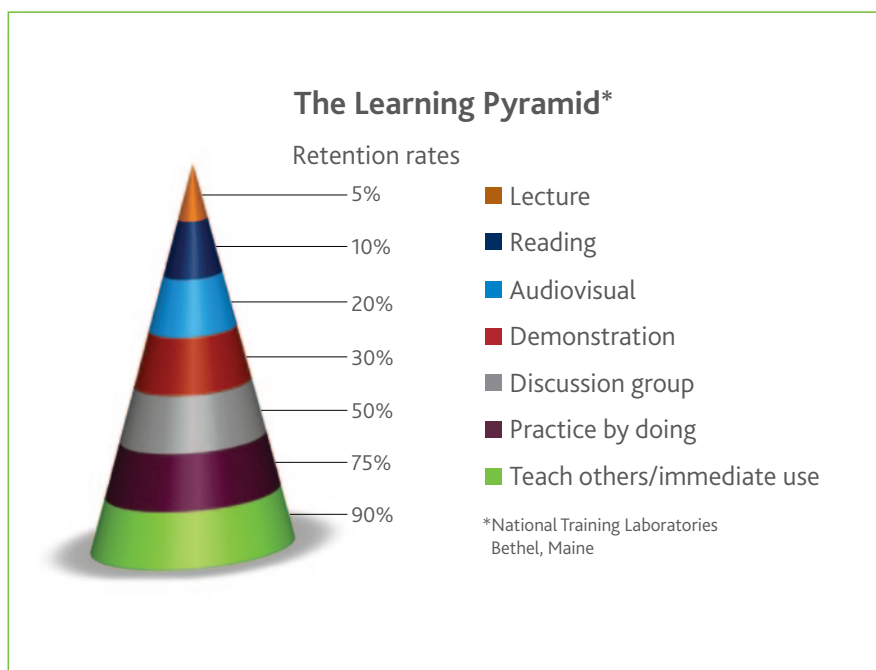
Scores on standardized tests may not accurately reflect quality of care provided by experienced clinicians. One possibility is that increasing clinical experience compensates for the decline in knowledge and is equally important for delivering high-quality care. However, studies evaluating the relationship between clinical knowledge and experience have generally concluded that the decline in knowledge is accompanied by a decrease in quality of care.

A systematic review of 59 such studies found that physicians who had been in practice longer had less factual knowledge; were less likely to adhere to agreed-upon standards of care; and may have worse patient outcomes [4]. As an example of the types of outcomes evaluated, one study included in the review found that compared with older physicians, those under the age of 40 were more likely to administer therapies that had been proven to increase survival after myocardial infarction, such as thrombolytic therapy, beta blockers and aspirin [5]. In another report, physicians who had been in practice for more than 20 years were less likely to recommend contemporary approaches to cancer screening [6].

Traditional Forms of Continuing Medical Education Are Ineffective

Clinicians have historically relied on continuing medical education (CME) activities to acquire new knowledge and skills. However, traditional forms of continuing medical education such as lectures, medical conferences and self-directed reading are ineffective for achieving sustained learning, and cannot hope to address the rapid pace at which medical knowledge grows. Studies of physicians who attended CME conferences or read biomedical literature on their own suggest that retention rates were less than 10%. Furthermore, didactic types of CME (e.g., lectures) do not change physician performance or improve patient care [8].

By contrast, interactive learning, and learning that is sequenced or reinforced in multiple sessions, improves retention and has the potential to improve quality of care [7]. Thus, resources that can provide learning at the point of care have great promise in facilitating continual learning. Use of one such resource (UpToDate®) proved to be an independent predictor of performance on a standardized test of medical knowledge among residents at the Mayo Clinic [8]. Use of UpToDate for only 20 minutes a day during routine patient care had the same effect on test performance as an entire year of residency.

The Learning Pyramid*

Retention rates

- 5%
- 10%
- 20%
- 30%
- 50%
- 75%
- 90%

■ Lecture
■ Reading
■ Audiovisual
■ Demonstration
■ Discussion group
■ Practice by doing
■ Teach others/immediate use

*National Training Laboratories Bethel, Maine

Too Many Clinical Questions Go Unanswered

Given the difficulty in acquiring and maintaining knowledge over time, it is not surprising that physicians report having many questions arise during the course of patient care. Multiple studies have evaluated clinical questions that arise in practice [9-13]. These data suggest that every two to three clinical encounters generate a question, and that clinicians have about 11 clinical questions per day. However, only 40% of questions are ultimately answered; answering all questions could change five to eight management decisions a day. These findings are concerning because clinicians continue to make decisions despite potentially serious gaps in knowledge, possibly jeopardizing patient safety and leading to inefficient and poor-quality care.

Studies evaluating questions asked by clinicians have identified several barriers to information-seeking behavior. These can broadly be defined as clinician-related and resource-related [9]:

PHYSICIAN-RELATED

- Failure to recognize an information need
- Decision to pursue answer only when answer thought to exist
- Preference for most convenient rather than most appropriate resource
- Tendency to formulate questions that are difficult to answer
- Forgetting the question
- Question not recognized as being important

RESOURCE-RELATED

- Excessive time and effort to find answer in resource
- Difficulty navigating overwhelming body of literature
- Inability of literature search technology to directly answer questions
- Lack of evidence addressing questions that arise in practice

For questions that are pursued, physicians typically spent under two minutes searching for information, suggesting that whatever resource is used must be able to produce the answer quickly.

Answering all questions could change five to eight management decisions a day.

The clinical knowledge resources described below have addressed these barriers to varying degrees. One resource (UpToDate) has demonstrated that overcoming these barriers translates into improved quality of care.

Resources to Help Clinicians Answer Questions at the Point of Care

The following commercially available resources attempt to address the knowledge gap and provide clinicians with evidence-based information at the point of care [10]:

- ACP Pier
- ATTRACT
- Bandolier
- BestBETs
- BMJ Clinical Evidence
- Cochrane Database
- DARE
- DISEASEDEX

- DynaMed
- First Consult
- FPIN Clinical Inquiries
- InfoPoems/InfoRetriever (now Essential Evidence Plus)
- Medline
- PEPID
- UpToDate

Access to the biomedical literature in a searchable electronic form (e.g., Medline) is widely available, allowing clinicians to rapidly search for individual studies or reviews. In addition, multiple services are available that aggregate primary sources of literature and/or textbooks in a federated search, in some cases providing filters for types of studies and methodological quality. A limitation of these approaches is that they sometimes require clinicians to sort through multiple sources of information and distill them into an answer they can confidently take action on. This may not always be feasible because of time constraints and the methodological and clinical expertise needed to evaluate primary sources of data.

Furthermore, it may be difficult and at times impossible for clinicians to understand how a new study should be applied when considering previous studies and clinical experience. As an example, the ACCOMPLISH trial was a well-performed study of 11,506 patients with hypertension who were at high risk for cardiovascular events [11]. Patients were randomly assigned to initial combination therapy with an ACE inhibitor (benazepril) plus either a dihydropyridine calcium channel blocker (amlodipine) or a thiazide diuretic (hydrochlorothiazide). Outcomes (cardiovascular events) were significantly better in the amlodipine than in the thiazide group. The better outcomes occurred even though there was no significant difference in mean blood pressure between the two groups.

Most clinicians can easily understand the results of the ACCOMPLISH trial, but would have difficulty applying them to clinical practice. Questions raised by this study include: Should patients with well-controlled blood pressure who are currently on combination therapy with an ACE inhibitor/ thiazide diuretic be switched to an ACE inhibitor plus dihydropyridine calcium channel blocker? Do the results of this trial change the choice for initial monotherapy for hypertension, with a long-acting ACE inhibitor/ARB or a long-acting dihydropyridine calcium channel blocker being preferred so that the second class can be added if the patient responds but does not reach goal with the initial drug? Answering these questions requires an understanding of the preceding literature on therapy of hypertension, and expertise that most clinicians do not possess.

In contrast to the information-aggregating resources, other information services (sometimes referred to as being "preappraised") critically evaluate the medical literature, combine it with deep clinical domain expertise and summarize the recommendations in a succinct, searchable format. Such resources are potentially much better suited than non-preappraised resources for addressing the types of questions described above. Indeed, limited empirical data suggest that preappraised resources are more effective than alternatives for answering clinical questions [14]. This was illustrated in a study of 32 second and third-year residents who were randomly assigned to one of two different protocols for finding methodologically sound studies to answer clinical questions [12]. In protocol A, residents were instructed to search Medline first followed by a preappraised resource. In protocol B, the preappraised resource search preceded the Medline search. Both preappraised resources and Medline were needed to answer questions. However, protocol B (preappraised resource first) answered significantly more questions in under five minutes than protocol A.

> **Studies among medical students and medical residents have also found that UpToDate is the most commonly used preappraised resource and is rated most helpful.**

# Comparison of Evidence-based Knowledge Resources

There have been no studies that directly compared all the available resources, but most comparative studies have found UpToDate is preferred by clinicians and answers the highest percentage of questions by primary care clinicians and specialists [9-10, 13-17]. As an example, a study at the Memorial University of Newfoundland, Canada found that the five most-used evidence-based bedside information tools were UpToDate, BMJ Clinical Evidence, First Consult, Bandolier and ACP Pier [10]. UpToDate was able to answer the greatest number of clinical questions, and UpToDate and BMJ Clinical Evidence were both rated as easy to use and informative. Studies among medical students and medical residents have also found that UpToDate is the most commonly used preappraised resource and is rated most helpful [13-14, 16].

Using Evidence-based Resources at the Point of Care Changes Decisions and Improves Outcomes

The ability to answer clinical questions at the point of care has the potential to fundamentally influence decisions that have an impact on patient safety and quality of care. Several studies have demonstrated that providing evidence-based information during the workflow (such as alerts and reminders) can improve clinical decision making, although the benefits have been modest and inconsistent across studies [18-24].

Influence of UpToDate in Major Academic Medical Centers

% reporting UpToDate sometimes or often led to changes in management

Changed management

■ United States ■ Germany ■ Netherlands ■ Japan ■ Sweden ■ Brazil
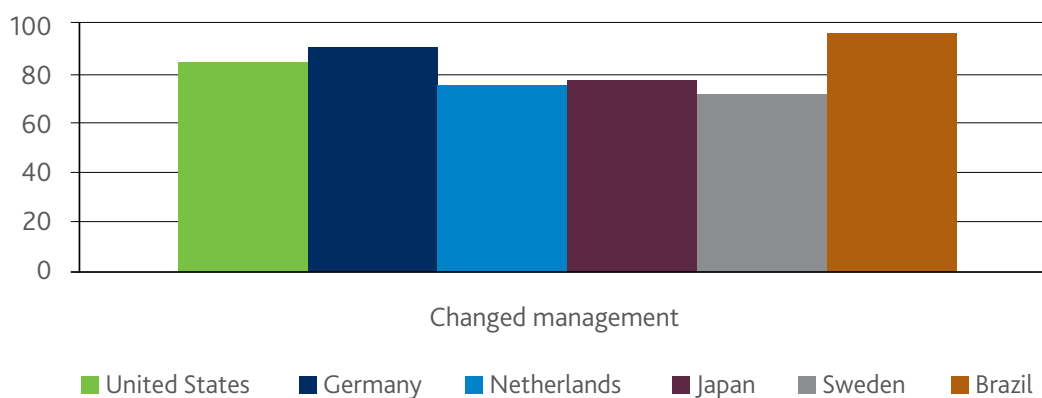
By contrast, few studies have attempted to evaluate the more general benefit of answering the myriad questions that arise in clinical practice. UpToDate topics are accessed frequently by clinicians — more than 11 million times per month. The widespread and frequent use of UpToDate has made studies possible that evaluate its impact on answering clinical questions, influencing decision making and affecting healthcare processes and outcomes.

Survey data suggest that clinicians use UpToDate to change diagnostic and management decisions, and that they feel UpToDate helps them improve decisions and provide better patient care. In a survey of physicians at an academic medical center in the United States, 91% reported that UpToDate was integral to making decisions [25]. In addition, 82% stated that use of UpToDate led to changes in management, 83% said it led to changes in diagnosis, and 47% reported that UpToDate allowed them to avoid a specialist consultation. All of the physicians stated that UpToDate helped them provide the best care for their patients, while 99% said it made them better doctors. Similar results have been reported in surveys of clinicians using UpToDate in the primary care setting and at small community hospitals (UpToDate Subscriber Surveys, 2005 and 2008). These results have been replicated around the world.

Equally as important, physicians reported that overall, answering questions with UpToDate saved time, and was faster or much faster than other means of finding information.

The effects of the decisions that physicians change by having clinical questions answered at the point of care are significant, as the examples in the table on the following page illustrate (Harvard Vanguard Medical Associates Survey, 2005).

Similar findings were noted in a study that looked at a random sample of 146 inpatients cared for by internal medicine attending physicians at a university hospital [23]. Critical decisions were assessed before and after providing clinical knowledge support. Treatment changed in 18% of patients after finding evidence that applied to the patient's condition, and most changed decisions were considered to have improved patient care. Examples of some of the decisions that were changed include:

- In a patient with a nonfunctioning arteriovenous graft, the physician was going to place a temporary vascular access, but after looking up information in a knowledge resource decided to instead give fibrinolytic therapy.

Effects Of Point Of Care Access To UpToDate

EFFECT	EXAMPLE
Avoided phone call/curbside consult	"I was about to call a cardiologist to answer the question, so this was not necessary"
Confirmed plan/knowledge	"Pretty sure OK to give, but wanted to confirm"
Saved time	"Would have looked for info elsewhere – more time-consuming"
Avoided specific testing	"May have drawn EBV titers"
Suggested correct testing	"I was not inclined to X-ray, but now believe it needs to be done"
Avoided complications	"I would have given higher dose of prednisone" "May have waited longer before treating very high levels in my patient"
Changed choice of drug or led to decision to discontinue a drug	"I would have used oral Keflex, which is less effective"
Raised additional issues to consider	"Had not realized the positive benefit of ACE inhibitors"

- In a patient with severe labile hypertension, the physician was going to administer diltiazem, but after looking up the appropriate information decided to give atenolol instead.

- In a patient with community-acquired pneumonia, the physician was initially going to treat with intravenous antibiotics but looked up information that made him feel comfortable prescribing oral antibiotics instead.

The changes in management associated with UpToDate use have translated into a measurable impact on patient safety, quality of care and hospital efficiency. In one of the largest studies, 424 hospitals with access to UpToDate were compared to hospitals that did not have access [26]. Hospitals with UpToDate had significantly better performance on risk-adjusted measures of patient safety, a significantly lower rate of patient complications and shorter length of stay. These benefits correlated with how frequently UpToDate was used at each hospital, supporting a causal relationship.

Additional studies are now being reported to validate these observations. In a cross-sectional study of 41 hospitals involving more than 167,000 patients older than age 50, higher scores on using clinical decision support were associated with a 16% decrease in the adjusted odds of patient complications [27].

The benefits of answering clinical questions using a clinical knowledge resource such as UpToDate compare favorably with other interventions designed to improve quality of care. Furthermore, compared with other forms of health information technology (such as electronic medical records systems, computerized physician order entry, and alerts and reminders embedded into such systems), clinical knowledge resources are relatively inexpensive, easy to implement, and well-liked by clinicians. Thus, these resources should be included in efforts to improve patient safety and quality of care.

> **The changes in management associated with UpToDate use have translated into a measurable impact on patient safety, quality of care and hospital efficiency.**

Summary

Practicing evidence-based medicine at the point of care is desirable, yet increasingly difficult as the volume of literature continuously expands and physicians are unable to keep up over time. In addition, even if physicians could keep up with the literature, placing study results in the context of the other published literature is difficult and beyond the skill set of the average physician. It is therefore not surprising that physicians have many questions at the point of care and that many of these questions go unanswered.

Preappraised resources that critically appraise the literature and summarize it into actionable recommendations are a possible solution to this problem. Many such resources exist, with one, UpToDate, currently the most widely accessed and studied. Research has demonstrated that clinicians will adopt these resources if they are quick and easy to use, frequently provide the answer clinicians desire, and provide trusted information. Physicians will change decisions based on use of these resources, and these decisions improve outcomes and give physicians confidence that they are providing better care for their patients.

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