A Forrester Total Economic Impact™ Study Prepared For UpToDate

The Total Economic Impact Of UpToDate's Clinical Decision Support System For Healthcare Institutions

A Case Study Of Salford Royal NHS Foundation Trust

November 2011

FORRESTER®

Headquarters | Forrester Research, Inc.
400 Technology Square, Cambridge, MA 02139 USA
Tel: +1 617.613.6000 | Fax: +1 617.613.5000 | www.forrester.com

TABLE OF CONTENTS

About Forrester Consulting
Forrester Consulting provides independent and objective research-based consulting to help leaders succeed in their organizations. Ranging in scope from a short strategy session to custom projects, Forrester's Consulting services connect you directly with research analysts who apply expert insight to your specific business challenges. For more information, visit www.forrester.com/consulting.

Executive Summary

An analysis of UpToDate use at one UK institution and subsequent financial analysis found that UpToDate offers a very attractive return on investment (ROI). Salford Royal NHS Foundation Trust (SRFT) experienced quantifiable ROI, covering all the costs of the service within 90 days. These measurable benefits come specifically from boosts in staff productivity and diagnostic test efficiencies.

SRFT's use of UpToDate, an evidence-based knowledge system, resulted in significant improvements in the quality of care. Gains in productivity and diagnostic test efficiencies equate to an ROI of fewer than three months, and the service aligns itself perfectly to broader National Health Service (NHS) goals for acute care centers.

The UK's NHS provides medical care to all legal residents of the UK through a system of tax-payer-funded trusts, clinics, and other health delivery systems. As with most countries, the downward pressures on taxation and government spending in the UK have been magnified by the growing global financial crisis. The NHS, which represents 18% of UK government spending, has been challenged by CEO Sir David Nicholson to find £20 billion in efficiency savings to reduce the burden of healthcare on taxpayers.[1] The Department of Health has outlined and started to implement its "Quality, Innovation, Productivity and Prevention" (QIPP) program to address the need to continue improving the quality of healthcare while limiting the growth in spending. Acute care centers are a particular area of focus for cost-cutting measures, while quality performance pressures remain.

In May 2011, UpToDate commissioned Forrester Consulting to examine the total economic impact and potential ROI UK hospitals may realize by deploying UpToDate's clinical decision support solution. In order to do this, an in-depth case study of SRFT, a large teaching hospital, was undertaken to provide readers with a framework to evaluate the potential financial impact of the UpToDate service on their own organizations and to understand the ways in which the use of UpToDate results in improvements in patient care and cost savings.

UpToDate is an electronic subscription service providing access to an evidence-based, regularly updated, decision support database that helps clinicians provide better patient care. All hospital staff can access the information quickly and easily online, and it is typically accessible on all PCs on-site. The service is also available to individuals, small practices, and educational establishments. For a more detailed overview about the UpToDate service, please refer to page 17.

UpToDate Improves The Quality Of Patient Care And Provides Compelling Financial Benefits

Both users and administrators of the UpToDate service at SRFT highlighted the improvements in the quality of care, as well as the educational and training benefits of the service. While these benefits result in significant potential financial returns, these are difficult to accurately quantify within the scope of a single hospital case study. However, other, more readily measurable benefits have also been identified, which, by themselves, cover all the costs of the service within 90 days, offering a very attractive ROI.

This study illustrates the financial impact of using the UpToDate service within the SRFT, a large teaching hospital near Manchester. It employs more than 5,000 staff members treating some 400,000 patients annually

and has one of the best hospital standard mortality rates (HSMR) in the country. An estimated 300 doctors, nurses, and students at SRFT access the service regularly to find the latest medical information about a wide range of different specialties, enabling them to provide better quality care, gain on-the-job, ongoing training, and work more efficiently. Our interviews with this existing UpToDate customer and subsequent financial analysis found that this hospital experienced the quantifiable ROI, costs, and benefits shown in Table 1. These measurable benefits come specifically from boosts in staff productivity and diagnostic test efficiencies.

Table 1
UpToDate: One-Year, Risk-Adjusted Benefits, Costs, And ROI Summary

ROI	Payback period	Total benefits	Total costs
402%	Within 3 months	£123,958	(£24,678)

Source: Forrester Research, Inc.

- **Benefits.** SRFT experienced the following benefits:
    - **Improved quality of care.** As stated by all the interviewees, quick and easy access to the latest medical information results in improved quality of care: Patients are diagnosed more quickly and accurately, resulting in reduced time to treatment. This, in turn, improves key hospital performance metrics such as mortality rates, adverse event frequency, waiting times, length of stay, and readmission rates. Although the interviewed organization acknowledges that the UpToDate service has a positive impact on these metrics, it was unable to quantify the impact; related studies suggest the potential for significant financial returns. One of the key administrators at the hospital summarized:

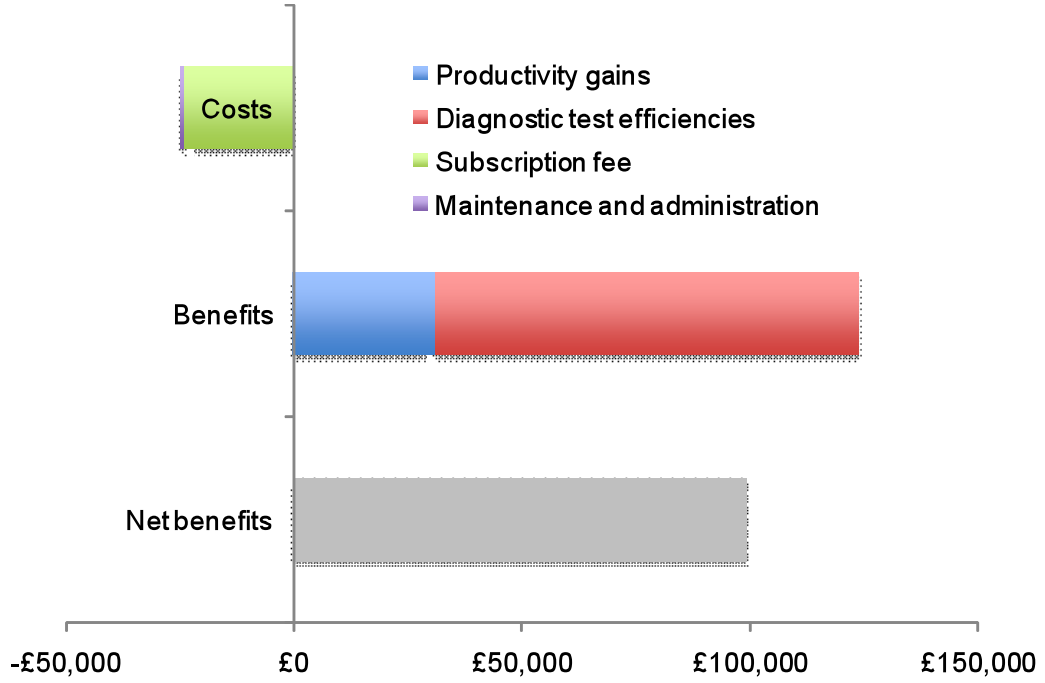
"The service provides an enriched environment, enabling doctors and nurses to provide the best care possible." (SRFT senior administrator)

    - **Improvements in productivity.** Users report that the service saves them time in finding and verifying important information for medical decision-making such as diagnosis and treatment pathways. Furthermore, it also saves doctors time when they are teaching students and junior doctors. On average, each of the 300-plus users of the service saves almost a day per year. This generates 25% of the benefits that were quantifiable within this case study.
    - **Diagnostic test efficiencies.** The service results in an avoidance of at least 1% of all diagnostic tests, a very conservative estimate; the corresponding cost savings equate to 75% of the benefits quantifiable within this case study. Consulting physicians report that the service has helped rule out certain possible diagnoses, thereby eliminating the need for many diagnostic tests.

- **Educational and ongoing training contributions.** UpToDate's service is an excellent educational and training tool, not only helping educate students and junior doctors but also providing ongoing medical education for experienced doctors and consultants, helping them keep abreast with the latest medical developments.

- **Costs.** The hospital experienced the following costs:
  - **Annual subscription fees.** The service is charged on an annual basis depending on the number of relevant clinicians at the institution. This cost represents more than 98% of the total costs of the service.
  - **Maintenance and administration costs.** A small element of the total cost of the service is its maintenance and administration, which only require a few hours per year.

Figure 1
UpToDate Service: Summary Of Quantifiable Risk-Adjusted Benefits And Costs



Source: Forrester Research, Inc.

A key point for all (both existing and potential) users of the UpToDate service is to maximize its usage: Costs are fixed, but benefits can continue to accumulate — in other words, the greater the usage, the greater the net benefits. To maximize usage, a number of best practices have been highlighted, such as requiring that the service

be introduced to all new medical staff as part of their induction, extending the service to additional user groups such as nurses, and employing the service as an on-the-job training tool.

Factors Affecting Benefits And Costs

Figure 1 illustrates the risk-adjusted financial results that were achieved by the interviewed hospital. The risk-adjusted values take into account any potential uncertainty or variance that exists in estimating the costs and benefits, which produces more conservative estimates. The following factors may affect the financial results that an organization may experience:

- Productivity gains depend on the ability of the concerned staff to reallocate their time productively.
- Doctors may not readily change the way they go about diagnosing conditions and so lead to a lower-than-expected decline in diagnostic test costs.

Disclosures

The reader should be aware of the following:

- The study is commissioned by UpToDate and delivered by the Forrester Consulting group.
- Forrester makes no assumptions as to the potential ROI that other organizations will receive. Forrester strongly advises that readers should use their own estimates within the framework provided in the report to determine the appropriateness of an investment in UpToDate.
- UpToDate reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.
- The customer names for the interviews were provided by UpToDate.

TEI Framework And Methodology

Introduction

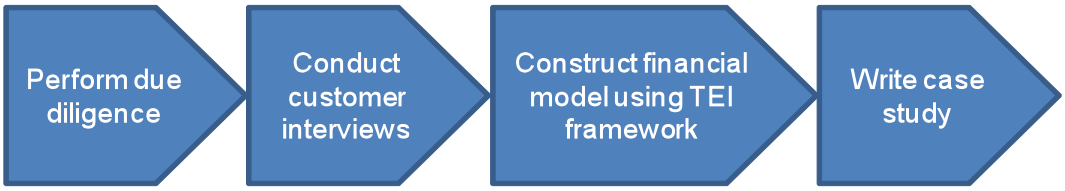
From the information provided in the interviews, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering implementing UpToDate. The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision.

Approach And Methodology

Forrester took a multistep approach to evaluate the impact that UpToDate can have on an organization (see Figure 2). Specifically, we:

- Interviewed UpToDate sales and marketing personnel and Forrester analysts to gather data relative to UpToDate and the marketplace for its service.
- Conducted interviews within one hospital currently using UpToDate to obtain data with respect to costs, benefits, and risks.
- Constructed a financial model representative of the interviews using the TEI methodology. The financial model is populated with the cost and benefit data obtained from the interviews as applied to the organization.

Figure 2
TEI Approach



Source: Forrester Research, Inc.

Forrester employed three fundamental elements of TEI in modeling UpToDate's service:

1. Costs.
2. Benefits to the entire organization.
3. Risk.

Given the increasing sophistication that enterprises have regarding ROI analyses related to IT investments, Forrester's TEI methodology serves the purpose of providing a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

Analysis

Interview Highlights

Forrester conducted four interviews for this study, involving representatives from the SRFT. This is a large teaching trust employing more than 5,080 staff, with 850 patient beds, and treating around 400,000 patients per year SRFT's core purpose is to provide clinical, academic, and service excellence, ensuring that the patient experience is at the forefront of care. It provides acute care services to the population of SRFT as well as the wider Greater Manchester and North West England region, and enjoys a strong-quality performance record: Its HSMR is among the top 10% in the country.

While the hospital strives to continue improving the quality of care it provides, it is also faced with finding significant cost savings as part of the NHS's QIPP initiative. The QIPP seeks to reduce the growth of NHS spending, and by 2015, annual savings of £15 billion to £20 billion will be required to keep within budget. Half of these savings will be found in productivity and procurement, the two largest components of the budget, and the other half by shifting care away from acute care centers. As such, SRFT's management have announced that they are looking for cost savings of 15% over the next three years — an ambitious target, given continuing pressures to provide more and better healthcare driven by factors such as the growing, aging population. The UpToDate service aligns itself very well with these important objectives.

SRFT has subscribed to the UpToDate service for seven years. During discussions with both users and administrators of the service, it is clear that it enables medical staff to provide better quality of care, as well as a number of other benefits:

- All users and administrators stressed how the service improves quality of care by enabling faster and more accurate diagnoses and reduced delays in commencing treatment. Doctors also highlight that it can be used to provide patients with information and graphical aids to help them understand conditions and treatments.

  "The service provides much quicker and better information, which has been checked by experts — I use it mostly for areas out of my comfort zone. It is fair to say that it therefore improves diagnosis." (SRFT senior doctor)

  ". . . in this example, the service helped in offering best possible care for this patient. I could have referred it to someone else, but otherwise, the patient would have worried for the next 4 weeks — so the patient is reassured." (SRFT senior doctor)

- Other intangible benefits, which have not been included in the financial calculations, include a strong contribution to education and training, both for students and qualified doctors; improved staff morale; and an enhancement of the reputation of the trust.

  "The service forms part of being a 21st-century educational establishment." (SRFT senior administrator)

- Productivity gains and diagnostic test efficiencies are the benefits of the service that have been quantified in this report.

"I would say that in an average week, it saves me about an hour or so." (SRFT senior doctor)

"It is very useful to clarify what conditions a patient does not have." (SRFT senior doctor)

- In addition to the annual subscription fee, there are only minor associated administration and maintenance costs.

Framework Assumptions

Table 2 provides the model assumptions that Forrester used in this analysis.

Table 2

Model Assumptions

Ref.	Metric	Calculation	Value
A1	Hours per week		40
A2	Weeks worked per year		45
A3	Consultant doctor annual salary[2]		£120,000
A4	Senior nurse annual salary[2]		£40,000
A5	Junior doctor annual salary[2]		£35,000
A6	Junior nurse annual salary[2]		£28,000
A7	IT/administration annual salary[3]		£35,000

Source: Forrester Research, Inc.

The time horizon used for the financial modeling is one year.

Costs

The main cost of the service is the annual subscription fee. We have also included administrative and IT costs the service incurs, but this is a very small amount and has a negligible impact on the financial results. It has, nevertheless, been included to demonstrate that there are no additional or hidden costs. There are no training costs because the service is very easy and intuitive to use, accessible to all hospital staff, and readily reachable within two clicks of the main intranet page. Training on the service forms part of the hospital's induction course for all new staff and also takes place as part of staff meetings and junior doctors' training.

Annual Subscription Charge

UpToDate's annual service charge is based on the number of clinicians within the institution whose specialties are covered by the breadth of the service. In the case of the SRFT, this charge was £24,269 in 2010.

Administration And IT

Service setup and maintenance add minimal, almost negligible costs, which have been included to provide a complete picture. It takes a technician less than an hour to enable the service on the hospital intranet site, and according to the interviewees, there have virtually never been technical issues in accessing the service. Also, a small administration cost is incurred in the annual service renewal. This takes around 21 hours in total, incurring a cost of just more than £400.

Benefits

All interviewees at SRFT pointed out that the UpToDate service provides two key benefits, namely, better quality of care and education. Providing doctors with quick and easy access to the latest, evidence-based medical information enables them to provide the right treatment faster. SRFT is also a teaching hospital, and the service has educational and ongoing training benefits. While it has not been possible to financially quantify these benefits, the benefits delivered through productivity gains and diagnostic test efficiencies have been estimated.

Improved Quality Of Care

Users and administrators of UpToDate highlight that the service improves quality of care and, in turn, has a positive impact on key hospital metrics such as mortality rates, waiting times, readmission rates, and length of stay, given faster diagnosis and a reduced time to treatment. While it has not been possible to quantify these benefits specifically in the case of SRFT using data obtained from a survey by Solucient, which compared the performance of several thousand hospitals, some broader indications and estimates are detailed below.[4]

Reduced Length Of Stay

By reducing time to treatment, the UpToDate service can help reduce length of stay. While interviewees agreed that length of stay could be a benefit from the use of the service, they also mentioned that it is unlikely to be an everyday event and that it is difficult to estimate how much this might be the case. However, by reducing the time to treatment, conditions deteriorate less, typically enabling patients to recover more quickly.

Each day of decreased hospital stay saves at least £250; the Solucient survey concluded that UpToDate, on average, saves 0.167 bed days per inpatient. This could therefore save Salford hospital £2.2 million annually or almost 9,000 bed days. Extrapolating to the NHS as a whole, this could amount to several hundred million pounds.

Lower Emergency Readmission Costs

A similar argument pertains to readmissions, with earlier treatment leading to lower readmission cases. A new policy from the Department of Health, which came into force on April 1, 2011, disallows primary care trusts from paying hospitals for emergency readmission of patients within 30 days for many elective procedures.

Acute centers of care typically stand to lose £3 million to £5 million annually for such cases; so by reducing readmissions, hospitals can reduce the impact of this decline in income.[5]

Other Quality-Of-Care-Related Benefits

Improved quality of care can also result in lower adverse events or complications, again through earlier access to treatment, for instance. This can result in improved metrics such as HSMR, which, if below the expected rate for a given hospital, can result in costly regulator intervention. Furthermore, this can also lower litigation rates and criminal negligence costs. In the case of SRFT, litigation costs amounted to £3.5 million in the 2009 to 2010 period. At the national level, this amounted to £787 million in 2010, providing important opportunities for care improvement and, ultimately, cost reduction.[6]

Doctors at SRFT also mentioned that by being able to diagnose faster, the quality of care is improved by reducing patient concerns. Some savvy patients also like to learn about their ailment, and so doctors can use the service to provide documentation and graphical aids about conditions and treatments.

Education And Training

Education and training are also key elements of the service's benefits. Indeed, for some, this is the most important aspect of the service, and an important portion of the funding for the service comes from the educational budget. As a teaching trust, SRFTwants to attract high-quality students, many of whom are driven through reputation, which is, in turn, enhanced by the provision of quality-focused services such as UpToDate. SRFT receives 7% of its income (almost £23 million) through its educational role. Students find it a useful resource for completing projects and reading about different conditions and treatments. Furthermore, the service helps continue the training of medical staff on an ongoing basis: It is updated monthly by experts in their fields, providing details of the latest medical developments, treatments, and drug breakthroughs. Indeed, in some countries, use of the service contributes to official requirements in ongoing clinician training and development.

Users of the service also highlighted that it can provide important reassurance for clinicians, providing the equivalent of a powerful, current, second opinion from leading experts around the world. This helps in making the role of a clinician less stressful and more rewarding. Productivity gains can also contribute to staff well-being.

All of these different aspects tend to go hand-in-hand: Quality of care is improved through better diagnosis and faster treatment; a strong reputation attracts better staff members; well-trained, informed, and motivated staff provide better service; and so on. One interviewee summed it up as follows: "The service provides an enriched environment, enabling doctors and nurses to provide the best care possible."

Productivity

Clinical staff saves time by having quick and easy access to the latest information about conditions, diagnoses, drugs, and symptoms. It also helps teaching consultants save time in accessing information during student and junior doctor training. Heavy users report time savings of up to an hour a week; it is estimated that the average user saves about 10 minutes a week. In the case of SRFT, this equates to 7.5 hours per user per year and, in total, 281 days for the institution as a whole.

To be conservative in our estimates of productivity gains, Forrester assumed that only 50% of the time saved is allocated to other productive tasks.

Table 3
Productivity Benefits

Ref.	Metric	Calculation	Value
B1	Number of users		300
B2	Average annual user time saving (days)	10 minutes per week*45/(60*8)	0.94 (7.5 hrs.)
B3	Total annual time saving (days)	B1*B2	281
B4	Average user salary[7]		£60,150
B5	Average user salary (per day)	B4/45/5	£267
B6	Annual productivity benefit	B3*B5	£75,188
B7	Productivity amount recognized	50%*B6	£37,594

Source: Forrester Research, Inc.

Diagnostic Test Efficiencies

Interviewees reported that the UpToDate service improves diagnosis and therefore saves costs by avoiding unnecessary tests.[8] This manifests itself in different ways: For instance, some doctors find that the service helps them eliminate some possible diagnoses, eliminating the need for certain tests to be undertaken. Others have mentioned that it helps them diagnose rare diseases, such as in the area of metabolics; accident and emergency departments also use it to help diagnose a very wide range of conditions. Similarly, doctors have also mentioned that the service is useful in diagnosing disorders that are out of their specialty area.

Table 4
Cost Savings From Diagnostic Test Efficiencies

Ref.	Metric	Calculation	Value
C1	Total hospital spend on key diagnostic tests		£11.2 million*
C2	Portion of diagnostic tests that can be avoided		1%
C3	Total diagnostic test efficiencies	C1*C2	£111,753

*Calculated from diagnostic test data and payment by result rates
Source: Forrester Research, Inc.

Total Measurable Benefits

The hospital enjoyed total measurable benefits of £149,347.

Table 5

Total Quantifiable Benefits

Ref.	Metric	Calculation	Value
D1	Productivity gains	B7	£37,594
D2	Diagnostic test efficiencies	C3	£111,753
D3	Total benefits	D1+D2	£149,347

Source: Forrester Research, Inc.

Risk

Forrester defines two types of risk associated with this analysis: implementation risk and impact risk. "Implementation risk" is the risk that a proposed investment in UpToDate may deviate from the original or expected requirements, resulting in higher costs than anticipated. "Impact risk" refers to the risk that the business or technology needs of the organization may not be met by the investment in UpToDate, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for cost and benefit estimates.

Quantitatively capturing implementation and impact risk by directly adjusting the financial estimates results in more meaningful and accurate estimates and a more accurate projection of the ROI. In general, risks affect costs by raising the original estimates, and they affect benefits by reducing the original estimates. The risk-adjusted numbers should be taken as "realistic" expectations, as they represent the expected values considering risk.

While we do not believe there are any implementation risks associated with the UpToDate service, the following impact risks that affect benefits are identified as part of the analysis:

- Productivity gains depend on the ability of the concerned staff to reallocate their time productively and may be lower.
- Doctors may not change their way of diagnosing conditions, resulting in a lower-than-expected decline in diagnostic test costs.

Table 6 shows the values used to adjust for risk and uncertainty in the cost and benefit estimates. The TEI model uses a triangular distribution method to calculate risk-adjusted values. To construct the distribution, it is

necessary to first estimate the low, most likely, and high values that could occur within the current environment. The risk-adjusted value is the mean of the distribution of those points. Readers are urged to apply their own risk ranges based on their own degree of confidence in the cost and benefit estimates.

Table 6
Benefit Risk Adjustments

Benefits	Low	Most likely	High	Mean
Productivity gain	50%	100%	100%	83%
Decrease in diagnostic test costs	50%	100%	100%	83%

Source: Forrester Research, Inc.

Financial Summary

The financial results calculated in the Costs and Benefits sections can be used to determine the ROI and payback period for the organization's investment in UpToDate. These are shown in Table 7 below, along with the risk-adjusted figures, using the numbers from Table 6.

Table 7
Initial And Risk-Adjusted Financial Summary

	Original estimate	Risk-adjusted
Costs	£24,678	£24,678
Benefits	£149,347	£123,958
Net benefits	£124,670	£99,281
ROI	505%	402%
Payback period	Within 3 months	Within 3 months

Source: Forrester Research, Inc.

UpToDate Overview

UpToDate is an evidence-based knowledge system authored by physicians to help clinicians make the right decisions at the point of care. All UpToDate content is written and edited by a global community of 4,800 physicians, world-renowned experts in their specialties. Supported by UpToDate's 45 in-house physician editors, these authors follow a rigorous editorial process, continually reviewing the content to ensure that it is of the highest quality and based on the latest evidence.

More than 30 research studies confirm UpToDate's widespread usage and its association with improved patient care and hospital performance. A study by Harvard University researchers published in the *Journal of Hospital Medicine* in November 2011 showed that hospitals using UpToDate experienced shortened hospital stays, fewer deaths, and better-quality performance than non-UpToDate hospitals.

"The data suggests the use of computerized tools such as UpToDate enable better decisions, better care, and better outcomes."

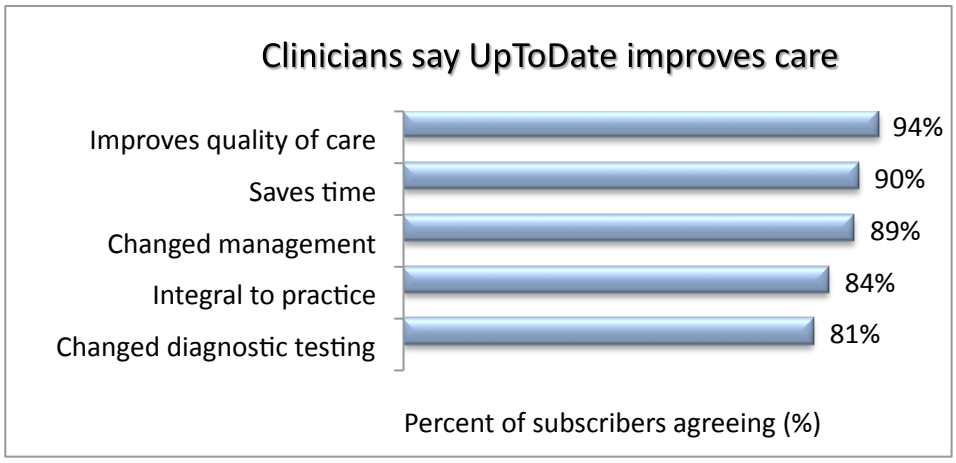
— Ashish Jha, M.D., M.P.H., Harvard University, and author of "Use of UpToDate and Outcomes in US Hospitals" study

A leading nephrologist and medical textbook author, Burton "Bud" Rose, M.D., founded UpToDate in 1992 to help clinicians practice the best medicine possible. He set out to create the digital equivalent of a trusted senior colleague who would answer questions and make recommendations at the point of care.

Today, by combining clinical knowledge and innovative technology, UpToDate has changed the way clinicians practice medicine and become an integral part of clinical workflows in institutions and practices worldwide. More than 450,000 clinicians in 149 countries trust UpToDate as their evidence-based knowledge resource at the point of care. That trust has been earned because of the integrity of UpToDate's recommendations:

1. The company never accepts funding from pharmaceutical companies, medical device manufacturers, or other commercial entities.
2. UpToDate utilizes a rigorous editorial process that clearly, concisely, and accurately answers clinicians' toughest questions, even when the evidence is thin or no consensus exists.

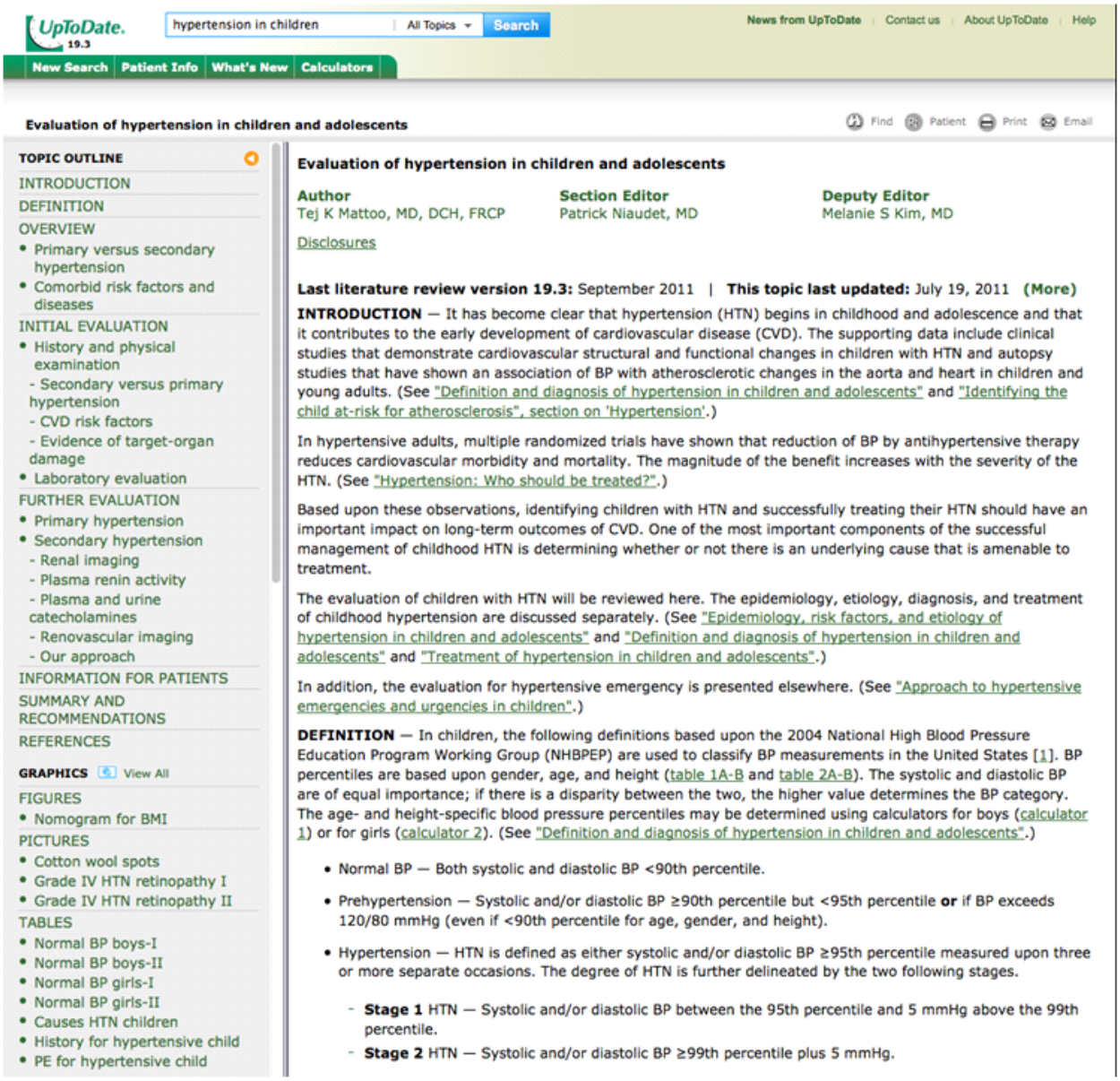
Figure 3
UpToDate 2010 Subscriber Survey



Source: UpToDate (Base = 14,091)

UpToDate is part of Wolters Kluwer Health, a leading global provider of information, business intelligence, and point-of-care solutions for the healthcare industry. Wolters Kluwer Health is part of Wolters Kluwer, a market-leading global information services company with 2010 annual revenues of €3.6 billion ($4.7 billion).

Figure 4
UpToDate Service Screen Shot



Source: UpToDate

Appendix A: Total Economic Impact™ Overview

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

The TEI methodology consists of four components to evaluate investment value: benefits, costs, risks, and flexibility.

Benefits

Benefits represent the value delivered to the user organization — IT and/or business units — by the proposed product or project. Often product or project justification exercises focus just on IT cost and cost reduction, leaving little room to analyze the effect of the technology on the entire organization. The TEI methodology and the resulting financial model place equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization. Calculation of benefit estimates involves a clear dialogue with the user organization to understand the specific value that is created. In addition, Forrester also requires that there be a clear line of accountability established between the measurement and justification of benefit estimates after the project has been completed. This ensures that benefit estimates tie back directly to the bottom line.

Costs

Costs represent the investment necessary to capture the value, or benefits, of the proposed project. IT or the business units may incur costs in the forms of fully burdened labor, subcontractors, or materials. Costs consider all the investments and expenses necessary to deliver the proposed value. In addition, the cost category within TEI captures any incremental costs over the existing environment for ongoing costs associated with the solution. All costs must be tied to the benefits that are created.

Risk

Risk measures the uncertainty of benefit and cost estimates contained within the investment. Uncertainty is measured in two ways: 1) the likelihood that the cost and benefit estimates will meet the original projections, and 2) the likelihood that the estimates will be measured and tracked over time. TEI applies a probability density function known as "triangular distribution" to the values entered. At a minimum, three values are calculated to estimate the underlying range around each cost and benefit.

Appendix B: Glossary

Discount rate: The interest rate used in cash flow analysis to take into account the time value of money. Although the Federal Reserve Bank sets a discount rate, companies often set a discount rate based on their business and investment environment. Forrester assumes a yearly discount rate of 10% for this analysis. Organizations typically use discount rates between 8% and 16% based on their current environment. Readers are urged to consult their respective organization to determine the most appropriate discount rate to use in their own environment.

Net present value (NPV): The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.

Present value (PV): The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total net present value of cash flows.

Payback period: The breakeven point for an investment. It is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.

Return on investment (ROI): A measure of a project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits minus costs) by costs.

Appendix C: Endnotes

[1] Source: ukpublicspending.co.uk (http://www.ukpublicspending.co.uk).

[2] This was the average salary in the NHS as of October 2010.

[3] This is the average for the Band 7 salary.

[4] Source: Peter A.L. Bonis, M.D., "Answering Clinical Questions Improves Patient Safety and Saves Money," Wolters Kluwer Health (http://www.wolterskluwerhealth.com/News/Documents/White%20Papers/Answering%20Clinical%20Questions%20Improves%20Patient%20Safety.pdf).

[5] Source: NHS Confederation and Foundation Trust Network.

[6] Source: NHS Litigation Authority.

[7] This was calculated by breaking down the usage of the service by the salary of the user. Forty percent of usage is by consultants, 5% by senior nurses, 25% by doctors, 5% by junior nurses, and 25% by students, according to a survey of users across the northwest region in July/August 2011.

[8] A survey conducted by the North West Strategic Health Authority in July 2011 reported that two out of three clinicians using the UpToDate service agreed that it helped avoid unnecessary diagnostic tests.