

Maximising the uptake of evidence into clinical practice

An information economics approach

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Summary Points

Information economics can help us understand how to maximise the uptake of evidence into clinical practice.

Evidence such as systematic reviews or clinical practice guidelines are information products, and clinicians are consumers of those products; their current proliferation by producers, but low uptake by consumers, suggests that we are in a situation of information oversupply.

Producers of evidence must consider the "market-share" that their information 'products' will attract amongst the clinical community and not just the scientific evidence behind them.

In the same way that a citation index is a measure of the impact that a scientific paper has within a research community, an evidence uptake index should give a clearer measure of the effectiveness of evidence products within the clinical population.

The uptake of evidence-based medicine may be hampered because the perceived cost of changing to it is too high. At present, most costs are born by individual clinicians but individual benefits for clinicians are downplayed in favour of population benefits.

Specific strategies to increase evidence uptake into practice include decreasing their 'cost of ownership', increasing the direct or perceived value of evidence resources in routine practice, and the customisation of evidence to suit different users, tasks and clinical contexts.

In an ideal world, every clinician would have immediate and easy access to advice on best practice and the supporting evidence. They would have the technology to find the information they need, the skills to understand it, and the resources to implement it. In the real world, even if there is a better treatment, not every clinician will know about it or seek it out.

Indeed, the uptake of evidence into clinical practice is low and has been a cause of concern amongst authors of systematic reviews¹. Practising clinicians on the other hand complain of being swamped by a growing tide of information. Systematic reviews and guidelines pile up in their offices and proliferate on the Internet, and there seems to be no hope of ever reading, let alone incorporating, the information into their pattern of care^{2,3}.

Information economics may help us understand this impasse, and assist in the development of strategies that increase the impact of evidence-based medicine (EBM) in clinical practice⁴. If one takes an economic view, then evidence, whether in the form of a systematic review or clinical practice guidelines, is simply an information product, and clinicians are its consumers. Evidence-based recommendations have to compete with every other piece of information that descends upon a clinician to gain their attention. For their part, clinicians as information consumers must make decisions about what information seems most useful or accessible to them, based upon their personal circumstances. The result of this interaction between evidence supply and clinician demand is an information marketplace.

The metaphor of a clinical information marketplace allows us to develop explanations for the current state of evidence-based practice. By all accounts, the global store of clinical evidence is growing rapidly, perhaps exponentially³. The current proliferation of evidence by producers, but low uptake by consumers, suggests that we are already in a situation of information oversupply. In this case, creating more guidelines will not increase the uptake rate, nor will berating the consumers for not wanting the product.

The consequence for information producers is that their success is increasingly dependent upon their ability to compete for the attention of information consumers. The consequences for consumers of information are equally as problematic. The amount of information that can be accessed or 'consumed' is fundamentally limited by human attention. As Nobel Prize winning economist Herbert Simon has famously noted: "What information consumes is rather obvious. It consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention"⁵.

As worryingly, theoretically it should become ever more expensive to find information. In particular, the costs of searching for and evaluating information have the potential to become increasingly expensive over time. If the amount of information is growing exponentially, then the number of documents that match a particular clinical question should also grow. For example, for a given amount of search effort, the probability of finding a document on the Web will decrease with time. In other words, the seemingly inevitable consequence of a global growth in information supply is actually an 'information famine' where we cannot find what we need⁴.

Clinical impact in the information marketplace - when better is best

For producers of information, the uncomfortable consequence of an ever growing information supply and scarce human attention is an economic 'Malthus' law of

information' that *the fraction of information produced that is actually consumed will with time asymptote toward zero*⁴.

The implication for those in the business of creating evidence 'products' such as clinical practice guidelines may be that the notion of the 'best' treatment needs to be replaced with a more complex notion of the most effective one in the information marketplace. Thus, guideline designers would need to consider how well their product competes for the attention of clinicians, and thus the "market-share" that a guideline will ultimately attract. They should also recognise that the level of adoption of any guideline is a reflection of the ease with which their product can be accessed, and its perceived utility amongst clinicians once it is accessed.

This suggests that rather than only assessing the clinical outcome of particular treatment, a measure of marketplace effectiveness factors in the likelihood that the clinical community will actually discover, and then adopt, the practice. In the same way that a citation index is a measure of the impact of a scientific paper within a research community, an evidence uptake index should measure the value of an evidence information product within the clinical population.

For example, assume we have a disease in which the baseline outcome with current treatments is 50% recovery. Two new competing treatments are introduced into the clinical information market via published guidelines. Treatment A has a 90% clinical success rate and 1% of patients receive it, based upon the adoption rate by clinicians. If B has only an 80% success rate but a 10% adoption rate, which treatment is the most effective? If we take evidence of clinical efficacy, then A is clearly superior. If however, we take the impact factor of a guideline to be the product of its improvement in outcome and its level of adoption amongst the population, B is 7.5 times as beneficial as A in terms of improvements to that population's outcome, and is clearly superior (see Box 1).

Thus, a guideline that does not have the best clinical outcome may nonetheless be the best when we consider its ease of adoption and consequent impact on the health of the population. While such a suggestion might terrify those who wish to see only "best-practice" adopted, it is in keeping with the ultimate goal of evidence-based medicine, which is to maximise the impact of research evidence on clinical practice. So, while traditional evaluations consider the costs and benefits of new treatments in isolation⁶, the most meaningful cost-benefit analysis is the one that reflects the true impact of a treatment in the community. The economic view emphasises that the costs and benefits of accessing and applying information are at least as important as are the costs and benefits of the treatments the information describe.

Market-based strategies for improving the uptake of evidence into practice

A substantial body of work now exists in the social and behavioural sciences that examines how personal and systemic changes occur, and these are being used to develop strategies that encourage clinicians to adopt evidence-based practices^{7,8}. The information economic approach shows how any personal change strategy also needs to be guided by the dynamics of information access, and the limitations to change when individuals are faced with information overload.

If clinical impact is going to be our measure for success, then designers of evidence products like clinical guidelines should not only devote their attention to identifying the best treatment. They must also seek ways of ensuring that their information

products are adopted widely. More profoundly, these are not independent activities - the design of an information product should take into account what consumers need and want.

In simplistic terms, there are only two ways to increase the uptake of the product. Firstly, the 'cost of ownership' of information can come down, making resource strapped clinicians more able to access evidence. Secondly, the value of information to the clinician could go up, increasing the perceived benefit to clinical practice. Clinicians should then be willing to devote preferentially more resources to accessing evidence than to other activities.

Increasing value for individual clinicians

When the commonly described costs and benefits of evidence-based practice are summarised (Table 1), a number of features are apparent. Firstly, the individual clinician sees a long list of potential personal costs and few personal gains in making changes towards evidence-based practice. Secondly, much of the benefit of EBM is couched in terms of benefit to the healthcare system or to patients, and there has been little emphasis on finding ways to make individual clinicians derive direct benefit. Protection from litigation and the comfort of improved decision-making are amongst the few cited personal benefits of EBM to clinicians. Certainly, an examination of current strategies to encourage EBM reveals a focus on explaining system rather than personal benefits to clinicians⁷.

If clinicians are to be induced to use evidence-based resources, then there needs to be clear advantages for the clinician beyond exhortations to the greater good. EBM should produce obvious and immediate benefits for clinicians at the point of care. For example, using a computer-based record system with evidence-based guidelines embedded in their design has the potential to deliver immediate benefits through automation. Selecting a guideline could automatically generate test orders, pre-prepare prescriptions, schedule tests, create elements of the patient record, call up patient educational materials, or even award CME points^{9,3}.

Decreasing the costs associated with evidence-based practice

Evidence-based practice imposes costs to clinicians both in changing their practice to embed EBM within it, as well as on an ongoing basis as they practice EBM. Some of the costs of change are financial and could be moderated through subsidy. Financial incentives clearly can work. For example, the Australian Federal Government's Practice Incentives Program has enticed GPs to computerise at a remarkable rate, with 65% claiming that they now use their computers to prescribe electronically, compared with 15% in 1997¹⁰.

Even though much clinical information is 'free' to clinicians, searching for information imposes a transaction cost on clinicians, at least in terms of their time and mental effort. As the amount of information that needs to be sifted through grows, such transaction costs will also grow⁴. A traditional way that consumers minimise the search costs for goods is to seek out a trusted supplier like a department store that on average delivers a high quality product at a good price. On the Web, information consumers similarly minimise search costs by constraining their search to areas known to contain high quality information that usually suits their needs. Such information 'portals' act like traditional department stores. Creating and supporting recognised portals containing high quality evidence will help minimise search costs to

some extent. However, more powerful information search and retrieval technologies will be needed as the body of evidence grows, and their development represents a challenge to the field of health informatics.

The form and complexity of an information artifact like a guideline also impose costs on those who use it. Good design should therefore focus not just on the 'message' that the designers wish to convey, but the medium they choose to convey it. For example, if clinical guidelines are overly complex we know that compliance rates by clinicians are lower¹¹. Some sacrifice of completeness of information seems to increase the clinical utility of guidelines. Such intermediate descriptions are sufficiently detailed for most uses but are not so detailed that they cover everything. There are also theoretical arguments for choosing intermediate complexity¹² that are supported by experimental evidence that the speed and completeness of information retrieval from medical records are best when intermediate levels of detail are used¹³.

Optimising evidence to suit the clinical context

The context of care imposes widely different constraints upon decision-making. Different user populations have different skill sets, education and resources and as a result their information needs may demand very different information presentations. One study estimates that up to 50% of the variation in compliance rate by clinicians with guidelines can be ascribed to the clinical setting¹¹. However, at present much of the focus of EBM methods is on identifying appropriate sources of evidence and generating as robust an opinion as possible about best practice. This is laudable, but ignores the fact that the results may not be framed in a way that is useable at the point of care. Rather than producing a single canonical document, versions should be optimised for a variety of different criteria.

Context specific versions of evidence can be created using computerised user models that capture the specific needs of individual groups and permit some automatic tailoring of evidence before it is presented¹⁴. Providing access methods that are optimized to local needs can also enlarge the range of clinical contexts in which evidence is used. For example, a clinician faced with an emergency that requires rapid decision-making is unlikely to leisurely browse through information on the Web, while that may be the perfect solution for less time-critical circumstances. The use of small mobile computing and communication devices, and voice-activated rather than text based services may help in circumstances where clinicians are mobile, hands busy, or time is limited.

Altering clinician's perceptions of value

Clinician perception is subject to a range of normal human biases that need to be accounted for when selling them the EBM value proposition. Experience in other domains shows that, despite "better" solutions existing, people stick with apparently sub-optimal solutions because the cost of changing is perceived to be too high¹⁵. In particular, cognitive psychologists have examined such behaviour and show that humans seem to give greater weight to losses than to gains, and weigh many small losses more strongly than a single gain¹⁶. Thus, faced with the long list of apparent personal costs and few personal gains associated with EBM (Table 1), clinician perception may be inherently biased against embracing EBM, independent of the true cost-benefit ratio.

Interventions could be crafted to assist clinicians in making more rational choices about adopting practices. Marketeers have evolved now familiar strategies to circumvent such human decision biases and alter consumer behaviour^{17,18}. Some of these are summarized in Box 2.

Decreasing the cost of production of good quality evidence

Even though in the short term clinicians may feel flooded with information about best practice, the dynamics of the information market means that good quality evidence will become harder to find over time. It is relatively cheap to produce poor quality but attractive information content on the Web, but the cost of generating good material is high¹⁹. For example, current methods for constructing critical appraisals, including hand searching of the literature and development of consensus statements are clearly labour intensive.

Consequently, there is merit in the argument that there should be some form of support or subsidy offered to those producing high quality information to ensure cheaper quality information does not swamp them over time grows. However, the simple assessment that we are experiencing exponential growth in the medical literature, but not in the numbers of those available to conduct critical appraisal means that we will soon need automated means for exploring, collating and disseminating best-practice knowledge. The development of such technological support remains an open and challenging area for computer science and informatics research.

Conclusion

The campaign to narrow the gap between what we know as a medical community and what we do as individual practising clinicians is still in its infancy. The evidence-based movement is learning that simply collating best-practice recommendations is not enough to influence the uptake of that evidence. The information economic model presented here works at least as a metaphor to help us structure our strategies to improve clinical practice.

One of the positive benefits of a true marketplace should be that the interaction between consumers and producers should generate products that best meet the needs and resources of the community as a whole. Well-formed marketplaces are spaces in which neither those who use products nor those who produce them are in control, but the outcome of their mutual interaction is satisfactory to both.

Optimistically, the economic way of thinking will result in the creation of a true evidence marketplace. Here, those who choose the evidence, whether patient or clinician, interact with those who create it to produce the optimum outcome for the community as a whole, harnessing its natural competition and selection forces to evolve our notions of evidence-based practice.

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Box 1 - Efficacy x Adoption Rate = Clinical Impact

Treatment *A* gives a 90% success rate, and achieves an adoption rate of 1% within the population of patients. The remaining patients use the baseline treatment with 50% success. The overall improvement to population health produced by *A* is thus:

$$\begin{aligned}\text{Impact of } A &= 0.9 \times 1/100 + 0.5 \times 99/100 \\ &= 0.504\end{aligned}$$

Treatment *B* gives a 80% success rate, and is used by 10% of the population. The remaining patients use the baseline treatment with 50% success. The overall improvement to population health produced by *B* is thus:

$$\begin{aligned}\text{Impact of } B &= 0.8 \times 10/100 + 0.5 \times 90/100 \\ &= 0.53\end{aligned}$$

The improvement produced by introducing *A* is thus 0.004, and by introducing *B* is 0.03. *B* thus has an impact 7.5 times as great as that of *A*.

Box 2 – Marketing tactics for increasing perceived Value

- *Separate gains*: A higher perceived value is generated when gains can be decomposed into individual items and valued independently. Explaining all the personal benefits of EBM to clinicians explicitly should therefore improve their assessment of its value.
- *Combine losses*: Similarly, perceived losses can be minimised when several losses are lumped into a single item. EBM systems that offer 'all-in-one' acquisition and access, and roll as many purchase and training costs as possible into one should be beneficial.
- *Avoid valuation of sunk clinical costs*: Presenting costs and benefits of the status quo and new practices should always be framed to ignore unrecoverable investments in past practice.
- *Separate small gains from large losses*: This is the 'cash back' effect that makes a consumer item appear more valuable when an expensive ticket price is offset by a small bonus. So, purchasing expensive computer equipment to provide access to guidelines may become attractive with bonuses like electronic prescribing.
- *Combine a small loss together with a larger gain*: By folding a loss within a larger gain, consumers may feel better off than if they were asked to value the loss and gain separately.

COSTS		
<i>To individual clinician</i>	<i>To patient</i>	<i>To healthcare system</i>
Purchase of guideline access technology	Lack of flexible management ²⁰	Process of guideline construction consumes time and resources ^{20,21}
Purchase of or access to guidelines	Population health needs may supersede individual needs ²⁰	Dissemination of guidelines
Learning EBM skills ²²	Non-guideline treatment may not be reimbursed ²⁰	Updating guidelines
Time to access guideline ^{22,23}	Decreased treatment choice	Investment in technologies for constructing, disseminating and accessing guidelines and evidence
Time to frame clinical question, read guideline and apply to individual patient ^{22,24}		Guideline recommendations may be poor ²⁰
Lack of guideline standardisation makes use harder ²⁵		One policy does not fit all ²⁶
Effort to resolve mismatch between guideline and clinical problem ²³		Expensive new treatments may be favoured ²¹
Learning new practice ²³		Excessive funds may be diverted to subsection of community ²¹
Personal inefficient with new practice compared to old		Commercial interests may use guidelines to disseminate products more rapidly than normal ²¹
Decreased clinical discretion ²¹		Guidelines may lead to over utilization of treatments ²⁰
Guideline does not show all options ²⁴		
Misleading or outdated advice in guideline ²⁰		
Use of non-guideline treatments generates criticism, litigation or does not attract reimbursement ²⁰		
BENEFITS		
<i>To individual clinician</i>	<i>To patient</i>	<i>To healthcare system</i>
Increased protection from litigation ²¹	Increased outcomes ²⁰	Decreased expenditure on treatments ²⁰
Increased quality of decisions ²⁰	Increased consistency of care across providers ²⁰	Support for quality improvement activities ²⁰
Decreased amount of literature that needs to be read ²⁷	Better informed patients ²⁸	Increased efficiency ²⁰
		Identify gaps in clinical evidence ²⁰

Table 1: A non-exhaustive catalogue of the costs and benefits of using guidelines in clinical practice for the individual clinician, the patient, and the healthcare system