The future of scientific medicine

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Editorial

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Some months ago in *CMAJ*, Dr. Olli Miettinen responded to the invitation of the editors to comment on the issues that surround the application of scientific evidence to the practice of medicine.[1] Miettinen's essay explores 2 closely related questions: What is the nature of the physician's professional knowledge? and What is the nature of the evidence that supports that knowledge? Miettinen argues that there are serious deficiencies in the evidence that shapes the physician's gnostic capability — not necessarily because there isn't enough of it, but because it has been gathered through research studies that ask the wrong kinds of questions.

Miettinen makes an important distinction between "specific" evidence (that is, the particulars of the patient's case) and "general" evidence (that is, aggregate or population-based evidence). When I was in China several years ago, I asked doctors who practised traditional medicine about the evidence that supported their work. I was told that every treatment regimen in traditional medicine is unique, since regimens are tailored to individual patients and individual patients are unique. It is therefore inherently impossible, they explained, to assemble aggregate ("general") evidence about the efficacy of many traditional practices. This perspective highlights the distinction that Miettinen makes and underscores the importance that Western scientific medicine gives to combining the "specific" with the "general."

The objective of clinical research is to generate general knowledge that clinicians can apply to the diagnosis and treatment of specific patients. Miettinen has grave doubts as to whether this is possible or, to put it differently, whether the kind of knowledge that clinical studies generate have any "*relevance* for the true concerns . . . of practice."[1] In his view, any single piece of clinical research is of little value unless it encompasses the entire "algorithm" or set of clinical paths for a patient (or cohort of patients) over an extended period of time. The problem here is that clinical questions are unanswerable by means of primary research if they are formulated too broadly. In fact, formulating a research question at exactly the right level is crucial to carrying out primary research that is both feasible and useful. Once a clinical researcher asks a question that is too broad (i.e., one that tries to examine rigorously what decisions should be made at multiple decision nodes in the pathways leading out from an initial decision) the research project becomes intellectually and methodologically overwhelming. Conversely, if the question is too narrow, the result is neither useful nor generalizable. Miettinen's call for rigorous analyses that cover broad clinical domains is righteous, but it remains to be seen whether it can ever be realized.

We might take some comfort, perhaps, in the discipline of decision analysis, which deals rigorously with algorithms and is applied increasingly to clinical problems. Decision analysis uses the results of many individual primary clinical studies as its "raw material," combining them into a result that covers a branching set of clinical pathways. But even decision analysis has trouble dealing with very broad sets of branching clinical pathways. Indeed, anyone who has ever tried to carry out a formal decision analysis knows that decision models involving more than a *single* decision node are both intellectually and computationally intractable.

The experience of decision analysts in this regard parallels the general experience of "line" decision-makers, who know that although they make most decisions by using some objective evidence, they virtually always combine that evidence with cognitive heuristics (rules of thumb, shortcuts, etc.) and with social and emotional considerations in a very unrigorous way to arrive at a decision.

McDonald's article on the way heuristics are used, and misused, in medical decision-making is quite revealing on this point.[2] Neurophysiologists have recently become interested in this question and have come up with the beginnings of an explanation of why it is that we make decisions this way.[3] Other approaches to integrating units of primary research evidence across a broad set of clinical decision paths have been described and are interesting.[4,5]

Miettinen's vision of the future of scientific medicine as one in which the leadership, then the rank and file, will become adept at the theory of gnosis, at carrying out gnosis-oriented original research and ultimately at synthesizing and interpreting the evidence from it is inspiring — and daunting. The science of synthesis is, unfortunately, in its infancy. After all, the randomized controlled trial in medicine is only 50 years old this year. And while Miettinen is gloomy about the current state of the art of meta-analysis (a pessimism that I do not share), surely it is better to rely on even a moderately well-executed systematic review than on the informal, often distorted "synthesis" of evidence that goes on in the heads of individual practitioners.

What is more useful is Miettinen's attention to the importance of the research protocol, which, along with its execution, determines the validity of the study. Translated, this means study design. My experience of editing the *Annals of Internal Medicine* for 3 years jibes exactly with this view: weakness in experimental design — not defects in analytical methods, results, organization or anything else — is far and away the commonest single reason for rejecting a paper.

Miettinen's vision implies that as clinicians we are currently incapable of making correct or useful decisions because we do not understand what gnosis is all about and cannot either generate or appreciate evidence. This reminds me of the story about the engineers who concluded from extensive and highly sophisticated modelling of the physics of bumblebee wing movements that bumblebees cannot fly. Although I would hardly argue that current clinical decision-making is optimal, I would submit that practising clinicians do in fact process staggering amounts of information and make pretty reasonable decisions, day in and day out. Rather than pushing the leadership of medicine in the next few decades into becoming gnosis mavens, therefore, it might be more productive to study seriously and intensively the minds of average individual working docs (and patients) to see how they manage to make decent decisions in the face of awesome amounts of information and under conditions of substantial uncertainty.

References

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