

Commentary

Translating research evidence into clinical practice: new challenges for critical care

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Abstract

High quality research evidence is now available to guide and shape the practice of critical care. As the generation of such evidence increases, the challenge facing critical care medicine will be translation of this evidence into measurable improvement in patient outcome. Significant barriers to this process of translation exist that will require substantial effort and resources to overcome. We briefly review the nature of translational barriers to incorporation of research evidence into clinical practice and the conventional approach to surmounting these barriers, and provide examples of barriers and potential solutions to emerging therapies in critical care.

Keywords costs and cost analysis, critical care, evidence based medicine, reproducibility of results, research

Practicing evidence based medicine relies on making evidence from clinical research available to support medical practice. In cardiology or oncology, for example, there is ample evidence from large, randomized clinical trials on which to base current practice recommendations. In critical care, however, there has traditionally been a paucity of high quality evidence to guide and shape practice.

During the past several years such high quality evidence has begun to emerge. Examples include the randomized trials of low versus high tidal volume mechanical ventilation in acute respiratory distress syndrome (ARDS) [1], daily interruption of sedation in critically ill patients [2], and activated protein C in severe sepsis [3]. A major challenge facing critical care is the expeditious translation of such high quality evidence into care at the bedside. In addressing this, the specialty will no doubt benefit from experience accrued by colleagues in other fields. However, there are obstacles specific to critical care that may require novel solutions.

Levels of barriers

As has been experienced by other specialties, there may be logistical barriers to implementing evidence based practice at

the level of the clinician, the institution, or regional and/or national policy making.

Clinicians face numerous potential barriers. First, if no guidelines exist, then the clinician may not have the time or the skill required to appraise peer-reviewed literature critically. If guidelines already exist, then the clinician may either not have access to them, may lack the confidence to act on them without formal, specialized training, or may even apply them incorrectly. Clinicians may even reject the evidence out of hand, believing it to be inapplicable.

At the level of the institution, incorporating new evidence into policy documents depends on the degree to which such policies influence clinical behavior at that institution. Furthermore, this influence is tempered by how willing the institution is to displace long established, but often unproven provincial practices.

Regionally and/or nationally, implementing evidence based guidelines requires enormous resources. Health care systems continue to struggle with how best to disseminate health care policies, let alone specific evidence based

guidelines. For example, what educational techniques should be employed? What measures or standards should be used to determine compliance with the guidelines? What techniques should be used to improve compliance? Finally, how can updated guidelines be introduced without promoting further confusion? Because national and regional systems are responsible for socially and geographically diverse health care environments, all of these issues must also be adaptable to local needs and circumstances.

At each level, there is also the pervasive problem of cost. Clinician behavior is modified by many factors, but salary and reimbursement are among the most important. Practice guidelines that promote uncompensated work are unlikely to succeed in the long run, but financial incentives to promote practice guidelines may be expensive, difficult to construct, and potentially unethical.

For institutions, practice guidelines may be deemed unaffordable either by hospital administration or by key members of the health care system. For example, although the clinicians may wish to use a new and highly effective therapy, the pharmacy may be reluctant to stock it, concerned that broad use will be a 'budget buster'. Such concern may exist even if the therapy results in net savings for the hospital as a whole, for example by reducing the duration of stay in hospital.

At the regional level policy makers may be suspicious that, although evidence based guidelines may improve health care, there is an unacceptable increase in costs. Given that health resources are finite, efficacy is no longer the sole concern when evaluating an innovation; cost-effectiveness and total cost burden are crucial when deciding whether to adopt a potentially common treatment.

An example from cardiology

An example of all these barriers is the use of thrombolytic therapy for myocardial infarction. Despite widespread acceptance of its underlying rationale, enormous publicity, and strong clinical evidence of dramatic reductions in mortality, it was only slowly accepted into routine clinical practice. One study conducted 7 years after the introduction of thrombolytic therapy for myocardial infarction [4] showed that only half of the patients who might benefit from such therapy were receiving it. The barriers were multiple. At the clinician level the decision to institute thrombolytic therapy, a therapeutic modality that is familiar to most cardiologists, actually fell to emergency medicine physicians who had limited first-hand experience with thrombolytic agents and felt uncomfortable using them.

At the hospital level, there was an inconsistent effort to ensure emergency medicine physicians were educated in the use of thrombolytic agents. Compounding this, many institutions restricted prescribing rights to trained cardiologists, who were

sometimes reluctant to cede this privilege to non-cardiologists and yet not necessarily prepared to provide 24 hour response to the emergency department.

At the regional level there was minimal effort to measure dissemination and to determine whether thrombolytic agents were being used properly outside of the large academic centers; only later did circumstantial evidence arise that smaller hospitals were probably not using thrombolytic agents as frequently as were larger hospitals [5,6].

Finally, there was concern at all levels regarding the potential costs of the newer, more expensive thrombolytic agents, further paralyzing their dissemination despite compelling cost-effectiveness assessments [7].

Research into implementation

Paralleling the evolution of evidence based medicine has been research into how evidence can be implemented into practice – so called 'implementation research' [8]. Understanding how individuals and organizations absorb evidence and implement change has, in select circumstances, translated into fundamental improvements in health care. In most cases, however, this understanding remains elusive and no reliable, widely applicable way to modify behavior has been discovered. We have learned much about barriers to research transfer through our failed attempts to modify behavior.

Success in modifying a discrete aspect of medical practice has invariably been achieved through integrated, multidisciplinary strategies that meld concepts and techniques from epidemiology, education, marketing, psychology, sociology, and economics. Ways in which the principles of implementation research might currently be applied to high quality evidence include the following.

Formulating evidence based guidelines that promote best practice initiatives at international and national levels

Although an important first step is to gain national and international consensus, this alone is insufficient because hundreds of guidelines exist but are routinely ignored.

Developing and funding specific regional policies

This is theoretically important but difficult to accomplish practically. Although there have been important successes, such as a national cervical cancer screening program in the UK and elsewhere, such programs benefited from having financial incentives for physicians, relatively straightforward auditing procedures, and considerable political and societal pressure. Despite their success, however, even cervical cancer screening has not been adopted in all developed countries. Regional programs for more obscure and complex practices will only be more difficult, have greater costs, and involve more challenging political and social issues.

Aggressive outreach programs to local opinion leaders

Recruiting influential members of local medical establishments to champion the cause of evidence based medicine is an essential element of the process. Integral to this role is the local 'tailoring' of best evidence to foster a sense of local 'ownership'.

Incorporating tools to facilitate clinical decision making

Such tools can vary in complexity from updated textbooks to complex, computer-based algorithms that provide decisions based on actual patient data. Although there has been early success using computer-driven decision support tools in the intensive care unit (ICU) [9], their use has generally been limited to clinical trials and specific institutions. Wider use remains difficult because of cost and development issues.

Regional and institutional measuring of compliance, processes of care, and patient outcomes

Systematic measurement is key to quality improvement: it facilitates the identification and correction of barriers to implementation. Examples include the large, statewide cardiac surgery outcomes registries that provide feedback on which centers generate best outcomes [6,10]. Regional initiatives to measure ICU care now exist in many countries in Europe, in Australia, and in New Zealand, but have been limited in the USA [11]. However, most current efforts have lacked sufficient detail on how care was provided. This limits our understanding of why outcomes differ, hampering their value for process improvement and compliance with best practice standards.

Economic analysis demonstrating the cost-effectiveness of new treatments that may place sizable demands on health resources

Well-conducted economic analyses inform policy makers by quantifying the tradeoffs of costs and benefits probably better than any other tool.

Anticipating best practice dissemination in critical care

Given the barriers to implementing best evidence, and the limitations of existing strategies to overcome them, what might some of the issues be for the dissemination of best practice in critical care?

Activated protein C

This drug enters clinical practice with much the same fanfare as did thrombolysis. There are a number of parallels. First, at the clinician level, how the drug works and the concept of the intersection between the coagulation and inflammatory responses in sepsis are not yet widely assimilated. Second, there is a temporal component to administering activated protein C, so once again emergency medicine physicians may be called upon to be the vanguard for instituting a new therapy, even though it was developed in a different field of medicine. Third, the complexity of screening patients for this

therapy will undoubtedly slow its entry into widespread use. Even among those who specialize in treating the critically ill, reluctance to incorporate activated protein C into routine clinical practice may result, for example, from skepticism of its mortality benefit in the face of the present lack of outcomes data beyond the conventional 28-day study period.

At the institutional and regional levels, cost becomes a major issue. The lack of long-term outcomes data will hamper its adoption by institutional and regional policy makers who must focus on cost versus benefit. The enormity of the financial commitment required to implement routine use of this therapy at the regional level might prompt a careful auditing system that includes proactive screening of all patients with severe sepsis. However, the introduction of such a system is daunting from a financial and logistical standpoint.

Low tidal volume ventilation

The case of low tidal volume, plateau-pressure-limited mechanical ventilation for lung injury and ARDS reflects a different set of problems. Although no new pharmacologic or technologic innovation is needed to provide this therapy, its promotion will not be without a significant educational cost. Initially, efforts may be restricted to critical care practitioners and allied health professionals, but if the scope of this technique were to be broadened to other patient subsets then the educational effort may need to take on monumental proportions.

Even within the ICU, other attending physicians, such as trauma surgeons or pulmonologists, may have a different attitude or opinion regarding low tidal volumes to that of the intensivist. Significant biases may have to be overcome to convince providers of the 'unnatural' pattern of ventilation that is required to achieve the goals of a low tidal volume, plateau-limited approach. Regions and institutions may actually have a negative incentive with regard to this technique if they are concerned, perhaps unjustly, that the cost of longer ICU stay accrues with improved survival. This may be particularly true in view of the poor long-term outcome of ARDS survivors. This negative incentive may undermine screening and auditing efforts that will be essential to ensure that all patients who may benefit from the technique actually receive it.

Daily interruption of sedation

Daily interruption of sedative/hypnotic therapy in critically ill patients to avoid excessive sedation will probably face similar dissemination problems to those of low-tidal volume strategies. First, clinicians may be very reluctant to awaken patients they believe 'require' sedation. Overcoming this traditional care bias will be difficult and require considerable education for all members of the ICU team. Again, the intensivist, the ICU nurse, and other physicians involved in the patient's care may have opinions about the 'right' way to sedate a patient, and educational strategies to convince one

member of the team may not be successful in convincing others.

Successful introduction of daily interruption of sedation probably requires a comprehensive monitoring and compliance program. This obviously costs money – money that the hospital may be unwilling to spend, especially if it fails to understand the importance of this care approach. Similarly, this level of detail regarding ICU care is simply not on the ‘radar’ screen at the regional or national policy level, and it is therefore unlikely that any system-wide initiatives will be introduced to ensure compliance, despite the large improvement in patient outcomes recently reported by Kress and colleagues [2]. Overcoming these problems requires considerable raising of awareness by local thought leaders, perhaps with further studies demonstrating the optimal way to disseminate best practice protocols. Again, however, this costs money, and the funding will probably have to come from federal agencies because there is no obvious industry stakeholder.

Conclusion

Translating high quality evidence into improved patient outcomes is a complex process. The changes required are substantial and will not be without significant cost, although lessons can be learned from the introduction of new therapies in other fields. Comprehensive education programs aimed at physicians of all specialties, not just critical care specialists, will be the most effective. Taking the lead in these educational efforts should be multidisciplinary groups of physician ‘thought leaders’, whose role will be to ensure that high quality evidence makes its way from the international and national levels to the regional and local levels.

Comprehensive economic analysis, incorporating emerging outcomes data, may help institutional and regional planners to justify the widespread use of new therapies; practical screening, auditing, and compliance systems are almost certainly necessary. Development of such tools and ongoing research to discover optimal ways to overcome barriers to transfer of research will be expensive, and funding cannot only come from industry but also from federal agencies. However, if we learn how to translate high quality evidence into care at the bedside now, we will not only improve quality of health care but also ensure more rapid dissemination of future advances.

Competing interests

DCA provides consulting to Eli Lilly & Company (Indianapolis, IN) and has received research funds from Eli Lilly & Company related to the evaluation of activated Protein C. DCA also has NIH funding to evaluate clinical and economic outcomes of patients on the NIH ARDS Network.

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