
The Knowledge Translation Paradigm: Historical, Philosophical, and Practice Perspectives

Knowledge translation (KT) is a phenomenon that has been recently rediscovered by academic and organized medicine. The process of synthesizing scientific and practice information to create new understandings that can be disseminated and adapted for use by those who serve the public is a long-standing goal of medical research. As the world and medicine have become more complex, KT has become increasingly important for researchers, practitioners, and those who administer health care.

The Institute of Medicine (IOM) has helped promote the KT initiative most recently through the recommendations set forward in its report entitled *Crossing the Quality Chasm: A New Health System for the 21st Century*.¹ Despite a recent emphasis on KT by the IOM, KT was a factor in the creation of the IOM. The IOM itself is an offshoot of the National Academy of Sciences (NAS), established by President Lincoln in 1863 to “investigate, examine, experiment, and report upon any subject of science or art” whenever called upon to do so by any department of the government. In short, the NAS was the first independent U.S. governmental think tank.

The IOM owes its creation to the work of the NAS Board of Medicine.² The board was charged with developing recommendations related to the developing field of cardiac transplantation. Dr. Christian Barnhard of South Africa performed the first human cardiac transplant in 1967. The media attention (both lay and scientific) far exceeded that directed toward the Tet Offensive in Vietnam at the time. Organizations such as the American Hospital Association were concerned that an unscientific approach to transplantation might follow.

The Board of Medicine used a transdisciplinary committee of experts to develop its recommendations. The committee noted, “Cardiac transplantation raises new, complex issues that must be faced promptly.” Transplantation must be viewed as a “scientific exploration of the unknown, only the very first step of which is the actual surgical feat of transplanting the organ.” The committee further emphasized that the “surgical team” should have extensive laboratory experience and that there be

“systematic observations throughout the lifetime of the recipient.”

The committee’s recommendations identified cardiac transplantation (at the time of the report) as an experimental procedure for which informed consent was needed. Indeed, the procedure should not be done by all hospitals, rather only at hospitals having made the commitment to provide a full range of support services, including immunology expertise. The report received much lay and science press coverage, including articles in the *Saturday Review* and *New York Times*. The report findings were inserted into the Congressional Record by the chair of the Senate Medical Appropriations Committee. Considerable attention was given to the report by President Johnson and his Cabinet. Hospital accreditation rules and transplantation funding guidelines followed that led to an immediate enhancement of the process of cardiac transplantation.

This example of successful KT in the late 1960s was the impetus for the NAS to finally establish the IOM in 1970. The IOM has continued to use this KT formula to address issues of substance for the public and governmental agencies. Key elements in the IOM’s KT formula are shown in Table 1.

KT AND HEALTH CARE QUALITY

The problem of KT has been recognized for centuries in relation to the practice of medicine. A textbook example of this phenomenon is the delay in acceptance of hand washing now recommended before obstetric deliveries and surgical procedures.³ Despite widely known reports by Oliver Wendell Holmes, Ignaz Philipp Semmelweis, and Joseph Lister in the mid-1800s, it was decades until the practice of hand washing before these procedures became a standard practice.

In its *Crossing the Quality Chasm* report, the IOM reiterated its six goals for the future of health care.¹ The IOM encourages us to create a health care environment that is safe, effective (evidence-based), patient-centered, timely, efficient, and equitable. To do this, we must take advantage of the mechanistic and process knowledge that will bring the best possible care (given available resources) to the largest number of patients. Indeed, KT is a powerful tool for leveraging our clinical resources to optimize health outcomes.

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Table 1
Common Knowledge Translation Features Used by the Institute of Medicine

Commission of committee report by one or more stakeholder group(s) with specific tasks for the committee Selection of committee participants with diverse expertise relevant to the health care topic but extending beyond the fields of medicine, nursing, and dentistry Selection of committee participants without an apparent conflict of interest (e.g., no financial or professional relationship to the stakeholder group[s]) Guidance of the committee process by an Institute of Medicine staff member(s) experienced in committee process and consensus building Synthesis of available data, including the collection and analysis of unpublished, relevant administrative data Incorporation of specific recommendations for action targeting stakeholder group(s) and, if not the requesting stakeholder group(s), Congress and other governmental agencies Creation of executive report summaries, in addition to development of full reports with scientific references, tables, and appendices Use of established media channels for release of reports (e.g., Internet postings, Institute of Medicine print publications, coordinated media reports, congressional and governmental briefings, and regional forums, often in conjunction with organized medical groups)
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The IOM report noted that a quality-focused health care environment would be dependent on the development of systems of health care delivery. Within these dynamic systems, the

... challenge is to manage the growing knowledge base and ensure that all those in the healthcare workforce have the skills they need. Making use of new knowledge requires that health professionals develop new skills or assume new roles. It requires that they use new tools to access and apply the expanding knowledge base. It also requires that training and ongoing licensure and certification reflect the need for lifelong learning and evaluation of competencies.¹

Some KT strategies recommended by the IOM for building this health care environment are noted in Table 2.

OVERVIEW OF THE PHILOSOPHICAL BASIS OF KNOWLEDGE

The process of KT has ties to the concept of “paradigm shift” as popularized by Thomas Kuhn, PhD.⁴ Science does not progress via a linear accumulation of new knowledge but undergoes periodic revolutions called “paradigm shifts.” As anomalous results build up, science reaches a crisis, at which point a new paradigm that blends the old results along with the anomalous results into one new understanding is accepted.

Table 2
Institute of Medicine Strategies for Knowledge Translation Related to Health Care Quality¹

Ongoing analysis and synthesis of the medical literature Delineation of specific practice guidelines Identification of best practices in the design of care processes Enhanced dissemination efforts to communicate evidence and guidelines to the general public and professional communities Development of decision support tools to assist clinicians and patients in applying the evidence Establishment of goals for improvement in care processes and outcomes Development of quality measures for priority conditions

As scientists, we make observations that lead to a theory of causality (Observation: “If I do A, then B happens.” → Hypothesis: “B is causally linked to A”). Such a theory leads to an understanding based on predictability, specifically, “If I do a lot of A, I should get a lot of B.” This scientific understanding leads to acceptance of a “fact”: “If B is desirable, then I should be sure to do A.” These “facts” eventually become paradigms. In our example where B is a good clinical outcome and A is a specific intervention, the paradigm becomes “A is good medicine.”

These paradigms are artificial constructs that tie observations and our understanding of causal relationships together. However, if our worldview changes or anomalous observations are found, we must be prepared to shift our paradigm. For example, if outcomes C and D become more important than outcome B and if the relationship of A with C and D is actually an inverse relationship, intervention A should no longer be considered a desirable intervention. Similarly, if intervention E is found to provide more of outcome B at lower cost and/or less risk of harm, we must be prepared to recognize that intervention A is no longer the better intervention.

Although the above examples suggest that truth, as exemplified in our paradigms, should be easy to determine and apply to our clinical practice, there are many factors that must be weighted when building our clinical paradigms. For example, what is the strength of the evidence for any causal relationship? If several clinical trials in diverse populations at multiple sites have demonstrated a clinically relevant interventional effect for a new therapy with clear statistical advantage over standard therapy, we can generally feel good about the new therapy. However, even a well-done trial may have enrolled patients considerably different from the population you treat. Further, even if a tightly controlled study may demonstrate interventional efficacy, is the intervention truly effective when used broadly? Even if effective, do the benefits support the risks or even the implementation costs that always come with a major practice shift? Some have begun to note that even the sacred cow of computerized physician order entry has significant limitations, clinical risks, and, of course, huge implementation costs.⁵⁻⁸

Further, we must be aware of categorical imperatives, such as statements like “Emergency physicians should or should not do ‘X.’” For example, 30 years ago we

were told, “emergency physicians should not use neuromuscular blocking agents.” This common belief predated the widespread adoption of emergency medicine residency programs, rescue airway skill training, the routine availability of oxygen and carbon dioxide monitoring equipment, the understanding of induction pharmacology, and other factors that are standard today. Similarly, 20 years ago, we were told, “emergency physicians should not use cardiac markers in their decision making.” This statement arose because cardiac markers were relatively insensitive and nonspecific in comparison with today’s markers. Further, there was not an appreciation for the time-dependent release of cardiac markers with ischemia and limited opportunity for sequential use, as is done in today’s clinical decision unit.

Problems also arise when “processes” of care are substituted for true knowledge. For example, the Centers for Medicare & Medicaid Services (CMS) has told us that antibiotics must be given emergency department to all patients with pneumonia within four hours of emergency department presentation; if not, we are told that patients with pneumonia will do worse. By extension, if we do not give antibiotics to the admitted patient subsequently determined to have pneumonia, we are considered to have failed as physicians.

What is wrong with this “knowledge”? Clearly antibiotics should help the patient with a bacterial pneumonia, but is that intervention more important than other therapeutic and diagnostic actions that must be done for the patient? How critical is the four-hour window, and are there other emergency department system issues more important to address? Others have critiqued this CMS recommendation.^{9–11} They note that the association between clinical outcome and time of antibiotic therapy is based on retrospective observations. Patients with complex pneumonia presentations were recognized late and treated late; thus, outcomes were worse. Further, this process “knowledge”—currently a CMS pneumonia care paradigm—looks at the care of patients with pneumonia in isolation. How many patients with other conditions suffer in the rush to shorten the time interval until antibiotic administration? Finally, the paradigm does not acknowledge that more liberal antibiotic use (given to ensure early treatment of more patients) has an implementation cost (e.g., additional drug expense and adverse drug effects).

We must remember that today’s fact, knowledge, or paradigm may be tomorrow’s fallacy. We must continue to question authority, because medicine’s rush to judgment historically has produced harm as well as health.

“Truth is what stands the test of experience.”
—Albert Einstein

ACCEPTANCE OF A PARADIGM AS KNOWLEDGE

For a paradigm to be accepted as knowledge, it must fulfill both reasoning and experience. This perspective has been emphasized by philosophical empiricists from Aristotle to Roger Bacon. Thus, the paradigm that is described in a specific “knowledge translation” must be compatible with practitioner reasoning and experience.

How can we apply this? Let us assume that a paradigm has face validity as truth (knowledge). What factors might still block the application of that knowledge? There are a variety of potential barriers, including 1) concerns about the risk/benefit of the intervention, 2) comfort with current practice and outcomes, 3) rewards (including avoidance of penalties; e.g., legal liability) received from current practice and outcomes, and 4) lack of experience with a new approach.

How can we address these issues?

Align Reimbursement with Desired Practice and Risk-adjusted Outcomes

Financial reimbursement represents a major motivator for physicians in the United States. Further, cautious use of resources will occur if payment is linked to risk-adjusted outcomes, that is, those emergency physicians whose risk-adjusted outcomes are below average should receive considerably less than those who use similar interventions and achieve improved outcomes for their patients. With a focus on outcomes (e.g., functional status or years of life), we encourage physicians to focus on delivering the best patient-tailored care rather than simply copying a process of care that may not provide optimal results in the provider’s own population or clinical setting, not to mention for the provider’s specific skill set.

Provide Liability Protection for Desired Practice

In the United States, liability risk varies from state to state. In those states without tort caps, physicians are unlikely to change their practice paradigm unless there is clear evidence that the new paradigm provides some legal protection. Hence, dissemination of medical advances can be anticipated to lag in the more litigious states. Adoption of KT will generally require solid evidence of a beneficial effect outweighing risk, peer support, and a small cost of implementation (including minimal risk associated with a prolonged learning curve).

Enhance Acceptance at the Specialty and Health System Level

Peer recognition of the KT-informed practice paradigms is important. Such recognition of practice paradigms can also help align reimbursement and provide liability protection. Further, organizational acceptance of such paradigms helps align the public’s expectations with the new paradigms. However, organizational advocacy for KT-informed practice paradigms must recognize the dynamic nature of knowledge and that the discovery and analysis of anomalies will change our understanding of the world and the message to the public and health system providers.

Provide Realistic Training That Reinforces the Paradigm

Because reasoning alone will not lead to paradigm acceptance, physicians must have the opportunity to experience KT-informed practice paradigms. Experience through the use of simulation or clinical decision-making exercises should be provided across all levels of learners (i.e., medical students, residents, and practicing specialists) and incorporate other professionals on the emergency care team (e.g., paramedics, emergency nurses,

social workers, and, where appropriate, other physician and nonphysician specialists who will assist with patient care). This is especially important in the development of new practice skills.

Provide Nonpunitive Outcomes Feedback with Comparisons against Norms

Physicians have selected their career because they sense a higher calling to deliver care to their fellow humans. We should assume that all physicians want to deliver the best care possible to their patients. Without regular, objective outcomes information with good comparators, physicians will base their care on anecdotal feedback. A critical KT implementation gap is the availability of non-punitive outcomes feedback to providers related to their care. Although I have cautioned against the misguided use of process of care information, there are times when process of care information may be the best available surrogate for KT adoption. If used, such process of care information must be repeatedly demonstrated to be associated with the desired clinical outcomes.

Provide Technology That Delivers Just-in-time Knowledge

As the world and medical paradigms become more complex, where possible, technology should use built-in prompts to guide clinical decision-making toward best practices, identify circumstances when all therapeutic choices are associated with high risk, and highlight practice anomalies (i.e., circumstances where the common "best practice" approach may be ill advised) as they occur.

CONCLUSIONS

As emergency physicians, we will always be faced with difficult decisions for which even our current "best practice" will not yield optimal results. As scientists, administrators, and practitioners, we will seek to enhance our practice through the creation of knowledge and development of practice paradigms using our own reasoning and experience. Although I have identified some pitfalls associated with the use of KT, we should embrace KT as a tool that will help us incorporate the reasoning and experience of others into our practice. This is not a task for the faint, as it is the challenge of science itself. The formation, application, and questioning of new knowledge is never ending.

As cited in the IOM report entitled *Crossing the Quality Chasm: A New Health System for the 21st Century*¹:

"Knowing is not enough; we must apply.
Willing is not enough; we must do."
—Johann Wolfgang von Goethe

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