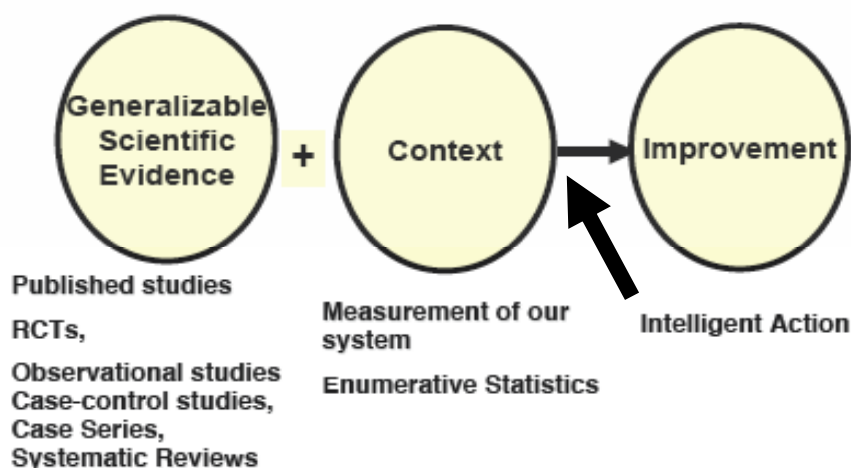


Context Knowledge and Generalizable Knowledge: The Underpinnings for Intelligent Action

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Objective: It takes both context knowledge and generalizable knowledge to provide a solid foundation for designing intelligent tests of change. Participants will learn the crucial role of these two types of knowledge to guide improvement efforts that result effective and sustainable improvement.



Introduction:

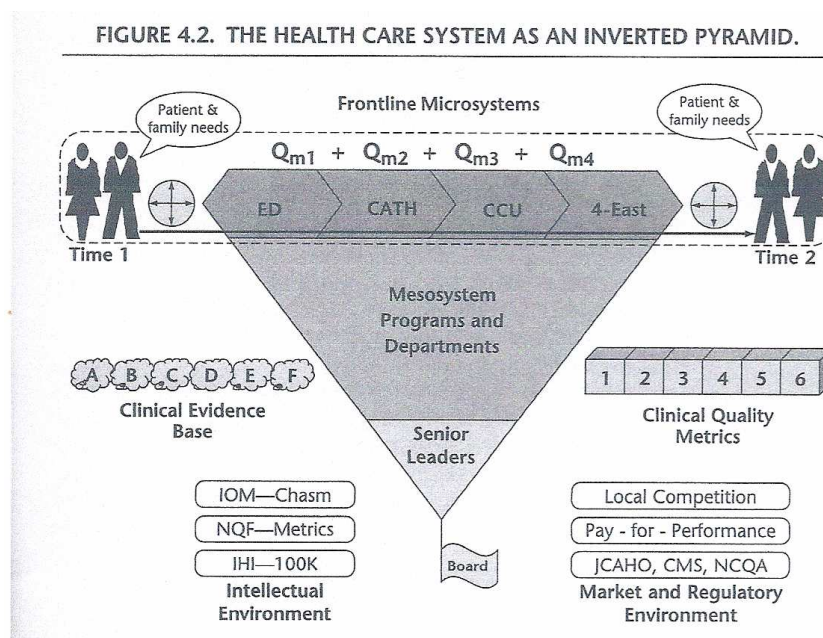
In our efforts to improve we can learn a great deal from the careful observation of others that are experiencing success. That is precisely the methodology used by J Brian Quinn, Professor Emeritus at the Tuck School of Business at Dartmouth College, in his research related to business management described in his best seller, *Intelligent Enterprise*. Quinn set out to learn why some Fortune 500 organizations became leading providers of services and products enjoying explosive growth and margins. Some experts have suggested that phenomenal success is frequently related to good marketing, good timing, or a company's good fortune to possess exceptional products or services. Quinn, however, showed that success was more related to a common core competency specifically, **a organization's relentless fixation with the front-line of their businesses**. In his study he found that companies that had a clear aim of continuously re-engineering the frontline interface relationship that connected the organization with the needs and desires of their customers enjoyed phenomenal success. He called this interface that includes the front line workers and the customer the "Smallest Replicable Unit" (SRU).

Successful organizations view the customer as king, they view the service providers as queen, and used process engineering to strengthen and improve this royal relationship. They created an information rich environment for the front line whereby the front line may become very knowledgeable about the quality of their work and the needs and wants of customers. Furthermore, great companies empower the front line to make changes that may result in service is highly reliable and that consistently meets the needs of customers.

What is a Clinical Microsystem?

Professor Paul Batalden, from *The Dartmouth Institute for Health Policy and Clinical Practice* (formerly known as *The Center for the Evaluative Clinical Sciences*), translated the “smallest replicable unit” concept to health care – calling these units clinical microsystems. He defines a Clinical Microsystems as follows;

“A health care clinical microsystem can be defined as a small group of professionals who work together on a regular basis – or as needed - to provide care and the individuals who receive that care (who can also be recognized as members of a discrete subpopulation of patients) It has clinical and business aims, linked processes, a shared information environment and produces services and care which can be measured as performance outcomes. These systems evolve over time and are (often) embedded in larger systems/organizations.”



From Quality by Design A Clinical Microsystems Approach (edit) Nelson EC, Batalden PB, and Godfrey MM. Jossey-Bass, San Francisco, 2007 p 75.

Use of the microsystems concept provides a framework to organize, measure, and improve the delivery of care. Clinics, emergency departments, cardiac catheterization labs, and cardiac surgery teams are examples of clinical microsystems. Microsystems exist in healthcare organizations regardless of whether they are recognized as such by the professionals that work in the system or the individuals that receive care within the microsystem. Study and improvement of healthcare organizations using the microsystem framework provides a focus of improvement at the point of care, a concept consistent with what Quinn discovered in his observation of successful enterprises. Figure 4.2 depicts how individual microsystems exist within a health organization. The overall quality of the care provided is built on the basis of scientific evidence depicted on the left and quality metrics (or measures) shown on the right. The mesosystem is comprised of departments that provide infrastructure to support the front line microsystems. The leadership's role is not to dictate how care will be provided, rather it is to provide support and empower the Microsystems in their journey to continuously improve. Senior leadership's role is to encourage this culture of engaging the professionals in continuously reflecting on their work and devising tests of change. Leadership should strive to develop a culture where there is a relentless desire by everyone to fulfill dual roles as both; providers of direct care to the patients and as the inventors /initiators of improved processes. The quality of the services provide by the microsystem are closely linked to the relationships and interdependencies of the professionals that comprise the microsystem. Microsystems are complex adaptive systems that may change for the better or for the worse. As professionals in the system begin to understand their interdependencies and develop a common mental model related to the care that they provide, the system will adapt and improve. In other words, when everyone see that it is their job to redesign care and they understand how their success in doing so is based on cooperation the system may adapt and improve at an accelerated rate. Providing professionals with two types of knowledge; generalizable evidence and context knowledge provides a foundation for change. Examining the generalizable scientific evidence is a look outward for best practices and the quest for context knowledge is an inward quest, examining the processes and patterns within the microsystem. These two types of knowledge form the foundation for change.

Generalizable Knowledge

Generalizable knowledge is usually obtained through basic professional education and is continuously expanding through information presented at conferences like this one, information reported in academic journals and writings. The scientific evidence is expansive in some areas and may be lacking in other areas of practice. Furthermore, the quality of the evidence is variable. Systems for classifying the evidence have been described. One such guideline for classifying evidence has been jointly published by

the American College of Cardiology and the American Heart Association. This model for establishing guidelines has been used for establishing many guidelines related to treatment of cardiovascular diseases including; management of patients with unstable angina, management of patients with peripheral vascular diseases, management of patients with acute myocardial infarctions, and management of patients with acute heart failure. Shann and colleagues used this method of classification and guideline development to writing guidelines for CPB related protecting the brain in patients that undergo procedures with CPB. More recently Ferrarias and colleagues have published a joint guideline endorsed by the STS and SCA related to reducing transfusions and coagulation disorders in patients undergoing cardiac surgery. These guidelines attempt to summarize the published literature and provide recommendations to clinicians based on a summary of the published scientific evidence.

Context Knowledge

Generalizable scientific evidence is of little value if it is not applied into the context of clinical care. We can be well versed on the pathophysiology related to a particular aspect of care. For example perfusionists may be well aware of the evidence related to temperature management during CPB. However, knowledge only becomes useful when couple with context knowledge related to how a system performs related to this known best practices. Context knowledge is specific knowledge related to the processes and patterns that occur in the microsystem. Context knowledge may be quantified by measurement of process related variables or outcome related variables. Variables related to processes may be identified to measure adherence to practices that may ultimately improve outcomes. Process related variables are variables that quantify the consistence of microsystem in the delivery of the care that it intends to deliver. A measure of the proportion of patients that receive an antibiotic at the time of induction is an example of a process variable. The proportion of patients that are effectively treated with Beta Blockers prior to surgery is another example of a process variable. Outcome variables are measures of the results of care. Outcome variables may be related to a summary of processes. For example, the rate of mediastinitis is an outcome variable and the rate of mediastinitis may be related to a number of processes including; glycemic control, transfusion rate, timing of antibiotic administration and central line care. Every system is perfectly designed to get the results that it gets. Thus, if one wishes to reduce the rate of mediastinitis, improvement efforts should be directed toward measuring processes related to this outcome. The Institute of Healthcare Improvement has proposed the use of “Bundles” as a structured way of improving the processes of care and patient outcomes. Bundles are a small, straightforward, set of practices (generally 3-5) that, when performed collectively and reliably, have been proven to improve patient outcomes. By reporting the adherence to the bundles back to the

microsystem the members of the microsystem gain context knowledge about how consistently they are able to deliver the care that they intend to deliver. This context may lead to a multidisciplinary groups generation of strategies to further improve adherence to agreed upon guidelines.

A “Real World” Example

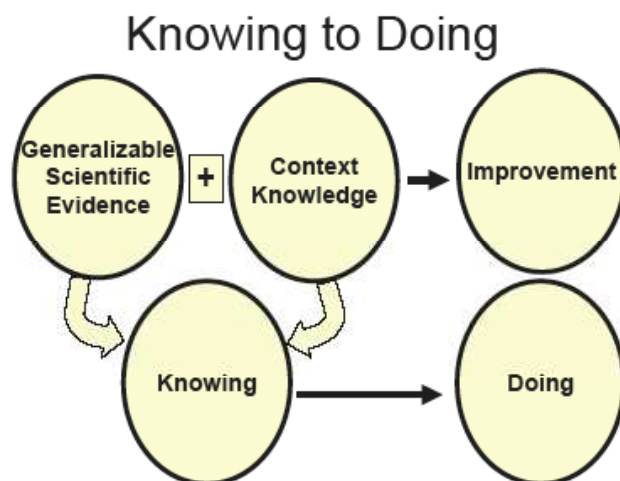
STROBEH Group Strategies to Reduce the Occurrence of Brain Embolism and Hypoperfusion

Embolization and hypoperfusion of the brain are the most frequently cited mechanism of cognitive injuries for patients undergoing cardiac surgery. Unfortunately emboli are commonly invisible to the surgical team, as their detection requires sophisticated monitoring modalities, such as Doppler ultrasonography. We were interested in improving the care to our patients with regard to neurocognitive protection during the surgical procedure. We developed a two fold strategy to help the team gain knowledge about embolism and hypoperfusion.

1. Evidence related to brain embolism was systematically reviewed and disseminated weekly to the team.
2. A monitoring model was developed to capture detailed information related to embolic counts in the inflow and outflow of the heartlung machine and emboli measured in the Right and left middle cerebral arteries. Cerebral RSO₂, patient physiologic parameters, and perfusion parameters were collected every 20 seconds. The monitoring model was used to capture detailed contextual information that would help us understand timing and the extent of a patients exposure to various conditions during CPB. A high definition video camera was used to record the fine processes of the surgical procedure carried out by the surgical team. Embolic activity in middle cerebral arteries was continuously monitored using transcranial Doppler sonography and cerebral and other vital physiological parameters were continuously recorded. The system captured and synchronized the video and physiological data to produce a detailed recording of the timing of emboli and the incidence of brain hypoperfusion. These recordings were used to produce recordings and graphical reports to inform the surgical team and develop strategies to reduce a patients exposure to these precursors to brain injury. Blood samples were also collected immediately before and 48 hours after the procedure for subsequent CNS biomarker analysis. Psychometric testing was performed immediately prior to surgery, prior to hospital discharge, and at three months.

Our focus thus far has been on microemboli. We have demonstrated not only that microemboli are common, but that reducing the number of microemboli leaving the CPB circuit leads to a reduction of embolic load in the cerebral arteries. Our initiatives to redesign the cardiopulmonary bypass through both clinical process and circuit redesign resulted in an 87.9% reduction in microemboli detected in the outflow of the CPB circuit, and a 75.8% reduction in microemboli detected in the cerebral arteries. Ultimately

changes in the CPB circuit lowered the CPB outflow count presently to below the cerebral microemboli count. Use of this strategy of sharing generalizable evidence and context evidence with our team has help use to realize a sustained reduction in exposure of patients to emboli.



Summary

Two types of knowledge are needed to bring about effective change. Sharing these two types of knowledge with the professionals that comprise the microsystem provides the underpinnings for effective and sustainable improvement in cardiac care.

“Insanity: doing the same thing over and over again and expecting different results.”

Albert Einstein 1879- 1955

“Knowledge is of no value unless you put it into practice.”

Anton Checkhov 1860-1904

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www.clinicalmicrosystem.org

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