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Achieving a High-Reliability Organization Through Implementation of the ARCC Model for Systemwide Sustainability of Evidence-Based Practice

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High-reliability health care organizations are those that provide care that is safe and one that minimizes errors while achieving exceptional performance in quality and safety. This article presents major concepts and characteristics of a patient safety culture and a high-reliability health care organization and explains how building a culture of evidence-based practice can assist organizations in achieving high reliability. The ARCC (Advancing Research and Clinical practice through close Collaboration) model for systemwide implementation and sustainability of evidence-based practice is highlighted as a key strategy in achieving high reliability in health care organizations.
Key words: *evidence-based practice, high-reliability organizations, patient safety*

HIGH-RELIABILITY ORGANIZATIONS (HROs) are those that achieve a high degree of safety or reliability despite dangerous or hazardous conditions.[1] They have defect-free or error-free operations for long periods of time.[2] The *Blue Angels* and the aviation industry are excellent examples of HROs. The *Blue Angels* are the United States Navy's Flight Demonstration Squadron and the oldest formal flying aerobatic team. They operate 6 F/A-18 Hornet aircraft and conduct more than 70 daring flight exhibits every year throughout the United States in which they perform many extremely dangerous maneuvers, including high-speed passes (often just under the speed of sound), slow passes, fast rolls, tight turns, and the Diamond formation. Training and performance require intense focus, strong leadership, effective communication, teamwork, data-based practices, root-cause analysis of errors, a safety and continuous learning culture, improvement processes, and an outcomes evaluation.

The health care industry, which has been fraught with an epidemic of medical errors, has looked to HROs to learn about and implement cultures along with practices that will lead to safer environments with a higher quality of care and efficiency. Every year, there are up to 200,000 unintended patient deaths, more than the number of deaths that occur due to motor vehicle accidents, breast cancer, and AIDS.[3] Patient injuries happen to approximately 15 million individuals per year. Only 5% of medical errors are caused by

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incompetence, whereas 95% of errors involve competent clinicians trying to attain the best outcomes in poorly designed systems with poor uniformity.[4] Furthermore, core processes in health care are defective 50% of the time and patients receive only approximately 55% of the care that they should when entering the health care system.[5]

The movement to improve patient safety in health care systems accelerated after the landmark publication by the Institute of Medicine of *To Err Is Human: Building a Safer Health System*.[6] Evidence regarding major factors that reduce errors in health care systems include (*a*) effective communication and transdisciplinary teamwork; (*b*) evidence-based interventions, which also improve standardization of care and decrease variation; (*c*) sensitivity to operations; and (*d*) improved systems design, which includes the use of checklists, decreasing interruptions, preventing fatigue, avoiding task saturation, reducing clinician stress, and improving environmental conditions.[1,7,8] In addition to the current emphasis on reducing medical errors, pay for performance has placed pressure on health care systems to improve their quality of care and prevent sentinel events.

One key strategy to improving quality of care is through the implementation of evidence-based practice (EBP). However, despite an aggressive research movement, the majority of findings from research are often not translated into clinical practice to enhance care and patient outcomes. At best, it usually takes several years to translate research findings into health care settings to improve patent care. In an era of cost-driven health care systems, research that demonstrates a reduction in costs has a higher probability of being adopted in clinical practice. For example, through a series of 6 randomized controlled trials, the efficacy of the COPE (Creating Opportunities for Parent Empowerment) program has been established with parents of hospitalized/critically ill children and premature infants. Findings from these trials have indicated that when parents receive COPE versus an attention control program, parents report less stress, anxiety, depression, and posttraumatic stress symptoms, up to 2 years following hospitalization.[9-14] In addition, their children have better developmental and behavior outcomes. However, it was not until a clinical trial using COPE with parents of preterms demonstrated a 4-day shorter length of neonatal intensive care unit (ICU) stay (8 days shorter for preterms younger than 32 weeks) that hospitals and insurers began implementing the program.[10] Routine implementation of the COPE program to the parents of the more than 500 000 preterm infants born in the United States every year could save the health care system between $2.5 billion and $5 billion per year.[15] This is an example of the "so what factor" in an era of health care reform, which is conducting research and EBP/quality improvement projects with high-impact potential to positively change health care systems, reduce costs, and improve outcomes for patients and their families.[16] Key questions that anyone should ask themselves when embarking on a research study or EBP/quality improvement project should be as follows: (1) So what will the outcome of the study or project be once it is completed? and (2) So what difference will the study or project make in improving health care quality, costs, or patient outcomes?

Estimates are that the cost of health care delivery in the United States is $2.3 trillion a year, a tripling of its cost in the past 2 decades.[17] Poor quality health care cost the United States approximately $720 billion in 2008. Wasteful health care spending costs the health care system $1.2 trillion annually. Half of American hospitals are functioning in deficit.[18] In addition to EBP improving patient outcomes by at least 28%, the US health care system could reduce health care spending by 30% if patients receive evidence-based care.[19]

HIGH-RELIABILITY HEALTH CARE ORGANIZATIONS

A high-reliability health care organization (HRHO) provides care that is safe and one that minimizes errors while achieving exceptional

performance in quality and safety. It has a measurable, near perfect performance on quality of care, patient safety, and efficiency. Creating a culture and processes that radically reduce system failures and effectively responding when failures do occur is the goal of HROs.

FIVE KEY CONCEPTS OF HIGH-RELIABILITY HEALTH CARE ORGANIZATIONS

The first key concept of an HRHO is sensitivity to operations, which is an awareness of the state of systems and processes that affect patient care. When an organization is sensitive to operations, potential errors are identified and prevented. In addition, actual errors are identified immediately and corrected.[20]

The second key concept of HRHO is a reluctance to simplify. It is positive to create simple processes in health care systems but not to oversimplify explanations for adverse events. For example, if a clinician makes a medical error, it would be simple to conclude that the clinician was the cause of the error instead of investigating the complete chain of events, from the physician's order to the filling of that order by a pharmacist to the delivery of the medication.

The third key concept in an HRHO is preoccupation with failure. Although it is very important to gather meticulous data on the number of medical errors or sentinel events in a health care system, when an error or adverse event happens, it is an opportunity to thoroughly examine the root cause for the problem and to make improvements.

The fourth key concept in an HRHO is deference to expertise. In an HRHO, leaders listen to and respond to others' insights, including direct care clinicians, patients, and family members. Input from others is taken into consideration in establishing care processes and strategies to improve safety and quality.

The fifth key concept in an HRHO is resilience. In an HRHO, leaders and staff need to be trained in how to respond when system failures do occur. They must be prepared and equipped with the right tools and resources to be able to respond to at-risk situations and prevent medical errors or sentinel events from occurring.[20]

In an HRHO, effective teams are key to optimal functioning. Characteristics of effective teams in HROs include (*a*) outstanding team leadership, in which team members have a clear vision and purpose and the roles of each team member are clear; (*b*) backup behavior, which is when team members are capable of self-correcting behaviors and feedback is provided regularly; (*c*) mutual performance monitoring, where team members understand and monitor each other's roles; (*d*) communication adaptability, in which communication is clear, often, and enough; and (*e*) mutual trust, in which each member of a team trusts each other's intentions.[21]

A CULTURE OF PATIENT SAFETY

Although a culture of patient safety is a necessity in an HRHO, it is often challenging to define and measure a safe culture. In a comprehensive literature review whose purpose was to organize the properties of a safety culture, Sammer and colleagues[3] identified the following as essential components: (*a*) leadership, in which key leaders are aware that the health care environment is one of risk and seek to reduce risk by aligning the vision/mission, staff competencies, and fiscal and human resources with frontline care; (*b*) teamwork, which includes collaboration and cooperation among leaders and staff members; (*c*) evidence-based, in which practices are based on the best evidence to improve standardization and reduce variation; (*d*) communication, in which the environment facilitates each member to speak up on behalf of a patient; (*e*) learning, in which the health care system learns from its mistakes and seeks to continually improve its processes and performance; (*f*) just, in which the culture is one that sees errors as system failures rather than individual failures; and (*g*) patient-centered, in which the care in the health care system is centered around the patients and family members.

MEASUREMENT OF PATIENT SAFETY

Data-driven decisions are an important part of an HRHO; therefore, careful monitoring of patient safety is essential. Scorecards can be used to track patient safety outcomes. For example, Pronovost and colleagues[1] describe the framework for a patient safety scorecard in an HRO that includes the following: (*a*) How often do we harm patients (measured by the number of medical errors or sentinel events, such as catheter-associated blood stream infections)? (*b*) How often do we provide interventions that patients should receive (eg, the proportion of patients who receive evidence-based interventions)? (*c*) How often do we learn from defects? (eg, the proportion of months that each patient care area learns from its mistakes and includes root-cause analysis along with revised policies to prevent future errors); (*d*) How well have we created a culture of safety? (eg, the percentage of patient care areas in which 80% of the staff report a positive safety and teamwork climate). The framework and concepts from an HRO are helpful in developing HRHOs. However, it should be remembered that, although concepts from HROs can be used to improve processes and outcomes in health care systems, they are not meant to replace safety and quality initiatives that are already being implemented and successful in improving outcomes.

RECOMMENDATIONS FOR LEADERS TO CREATE HIGH-RELIABILITY CULTURES

A variety of strategies can be implemented by leaders to create HRHOs. The first strategy is to conduct transdisciplinary team training in which all managers and staff are taught about HROs and methods to achieve them. The second strategy is deliberately designing key care processes to reduce risk and ensure high-quality care. Third, it is important that all members of the team understand its key processes. Fourth, it is critical to error proof the organization. The fifth strategy involves process standardization (ie, uniformity in how care is delivered to patients).[21] Finally, as part of building an HRHO, it is critical to cultivate a culture of EBP in which there is a never-ending spirit of inquiry within everyone in the organization regarding how to improve the quality, safety, and efficiency of care.

EVIDENCE IS KEY IN BOTH HIGH-RELIABILITY ORGANIZATIONS AND EVIDENCE-BASED PRACTICE CULTURES

Careful tracking of data along with outcomes monitoring of key system and patient outcomes is critical in an HRHO. Furthermore, external evidence from both rigorous research and internal evidence (ie, data that are generated from practice, patients, and outcomes management) is critical to formulating the best practices to improve the quality and safety of care. In an HRHO and an EBP culture, leaders engage in evidence-based management and clinicians engage in EBP. Evidence-based practice is a problem-solving approach to the delivery of care that integrates the best evidence from well-designed studies with a clinician's expertise, including clinical wisdom, reasoning, patient history, physical data collection and resource utilization, and a patient's preferences and values to make decisions about the type of care provided.[22] The ultimate purpose of EBP is to improve health care quality and patient outcomes and reduce hospital costs. When evidence-based care is delivered within an EBP culture and a context of caring, the best patient outcomes are achieved (Figure 1).

THE STEPS OF EVIDENCE-BASED PRACTICE

To build HRHOs and EBP cultures, clinicians should learn and consistently implement the steps of EBP, which include (1) cultivate a spirit of inquiry; (2) ask clinical questions in PICOT format, which stands for *patient* population of interest, *intervention* of interest,

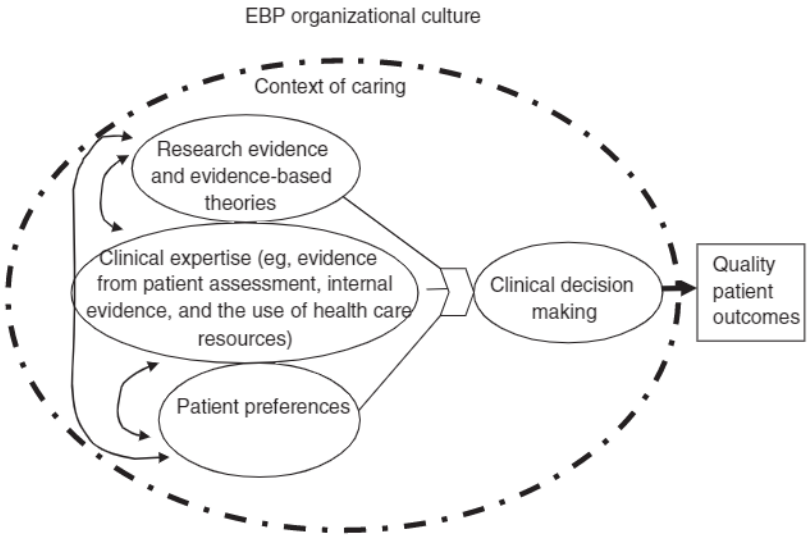

Figure 1. The evidence-based practice (EBP) paradigm. Copyright 2003 Melnyk and Fineout-Overholt.

comparison intervention or group, *outcome*, and *time* (eg, In intubated patients in the ICU (P), how does early ambulation (I) vs delayed ambulation (C) affect episodes of ventilator-associated pneumonia (O) while in the ICU (T)?); (3) search for the best evidence; (4) integrate the evidence with clinical expertise and patient preferences to make the best clinical decision; (5) evaluate the outcome(s) of the EBP change; and (6) disseminate the outcomes so that other patients can benefit. In EBP, if there is enough high-quality evidence from research to change practice, the practice is changed and outcomes are monitored to support that the change in practice based on research produces positive outcomes in the real-world setting. If there is not enough high-quality evidence to change practice, external evidence must be generated through rigorous research or internal evidence produced through quality improvement or outcomes management projects. High-reliability health care organizations begin with leaders and point-of-care providers who take the time to think and reflect about the care that is being delivered and continually ask how it can be improved, which is analogous to cultivating a spirit of inquiry or step 0 in the EBP process.

CHARACTERISTICS OF BOTH HIGH-RELIABILITY HEALTH CARE ORGANIZATIONS AND EVIDENCE-BASED PRACTICE CULTURES

There are many similarities between building an HRHO and an EBP culture. Characteristics of both are included in the Table. Both HRHOs and EBP cultures work to obtain the highest levels of health care quality, safety, and patient outcomes. Outcomes monitoring

Table. Characteristics of Both High-Reliability Organizations and Evidence-Based Practice Cultures

Commitment to delivering high-quality care and patient safety and reducing costs
Strong leadership
Emphasis on process and systems design
Transdisciplinary teamwork
Effective communication
Delivery/standardization of best practices and policies
An environment that promotes a spirit of inquiry and continuous learning
Focus on continual process improvement
Outcomes monitoring/evaluation

is a critical strategy in both HRHOs and EBP cultures because outcomes reflect the impact that is being made on health care quality, patient outcomes, and system outcomes.

BARRIERS TO AND FACILITATORS OF ADVANCING HIGH-RELIABILITY HEALTH CARE ORGANIZATIONS AND EVIDENCE-BASED PRACTICE CULTURES

There are multiple barriers to leaders and clinicians succeeding in developing an HRHO and an EBP culture. Some of the major barriers include (*a*) lack of knowledge and skills in both HRHOs and EBP; (*b*) perceived lack of time; (*c*) lack of organizational/administrative support; and (*d*) educational programs that continue to teach the "traditional way" with a focus on producing research instead of using evidence to improve practice; and (*e*) lack of mentorship.[23-26] Conversely, facilitators of building HRHOs and EBP cultures include (*a*) knowledge and skills of HRHOs and EBP, (*b*) beliefs that these types of organizations and cultures improve care and patient outcomes; (*c*) beliefs in the ability to implement EBP and key concepts of HRHOs; (*d*) mentors who are skilled in EBP and HRHO concepts; and (*e*) administrative/organizational support, including leaders and managers who model important behaviors related to EBP and HRHOs.[22,27,28]

THE ARCC MODEL AS AN EXAMPLE OF HOW BUILDING AN EVIDENCE-BASED PRACTICE CULTURE FACILITATES A HIGH-RELIABILITY HEALTH CARE ORGANIZATION

Use of the EBP paradigm assists organizations in achieving high reliability. There is evidence to indicate that implementation of evidence-based care helps reduce defects in care processes, improves quality of care and patient outcomes, standardizes care, decreases variations in care, increases efficiency and decreases health care costs.[1,22,25,29,30]

The ARCC (Advancing Research and Clinical practice through close Collaboration) model is a systemwide model that can be used by health care systems and hospitals for sustaining EBP and facilitating an HRHO (Figure 2). The ARCC model was first conceptualized in 1999 as part of a strategic planning process at a major medical center to rapidly integrate research findings with clinical practice for the ultimate purpose of improving quality of care and patient outcomes. Four assumptions are inherent in the ARCC model: (1) There are barriers and facilitators of EBP for individuals and within health care systems. (2) Barriers to EBP must be removed or mitigated and facilitators put in place for both individuals and health care systems to implement EBP as standard of care. (3) In order for clinicians to change their practices to be evidence-based, cognitive beliefs about the value of EBP and confidence about the ability to implement it must be strengthened. (4) A culture of EBP that includes EBP mentors (ie, clinicians with advanced knowledge and skills in EBP, mentorship, and individual as well as organizational change) is necessary to advance and sustain evidence-based care.[31]

Implementation of the ARCC model begins with an assessment of the culture and readiness for EBP, which allows for the identification of strengths and limitations within the health care system that either facilitate or hinder the development of an EBP culture. Next, a cadre of EBP mentors is developed whose role is to address the limitations, enhance the strengths in the health care system to build an EBP culture, and work directly with point-of-care clinicians in implementing and sustaining EBP. The ARCC model contends that, when clinicians are mentored in EBP, their cognitive beliefs about the value of EBP and their ability to implement it are strengthened, which results in greater implementation of EBP. Furthermore, when EBP is implemented, there is improvement in patient outcomes and clinician group cohesion and job satisfaction, which ultimately results in less turnover within the organization. To date, several studies have been conducted that have supported relationships among constructs in the ARCC model.[28,32,33,34]

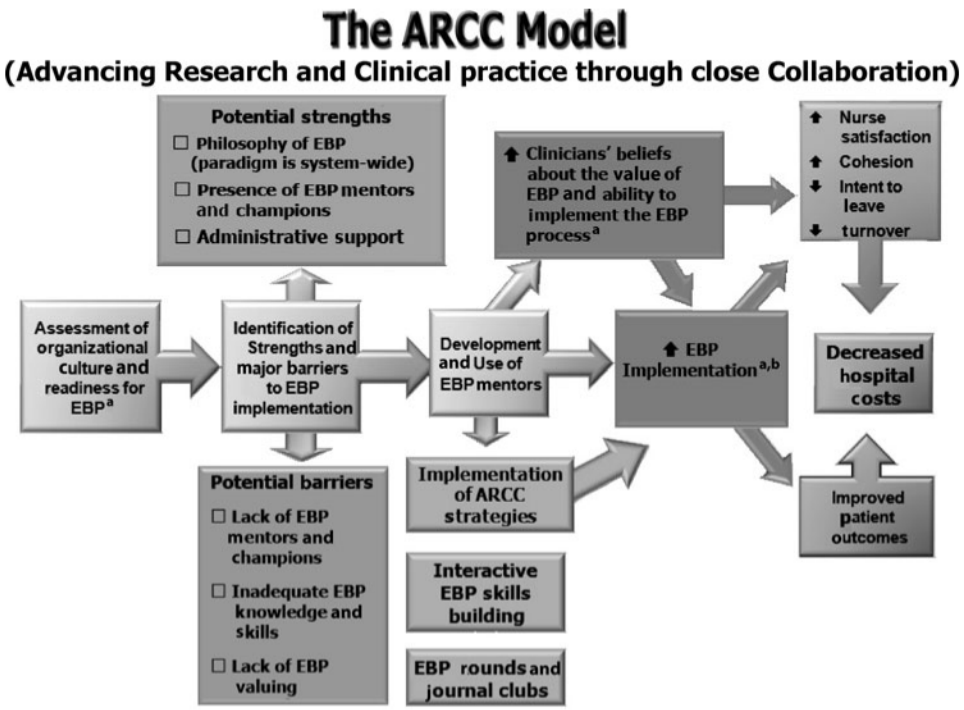

Figure 2. The ARCC model for systemwide implementation and sustainability of evidence-based practice (EBP) can facilitate a high-reliability health care organization. Copyright 2005 Melnyk and Fineout-Overholt. [a]Scale developed. [b]Based on EBP paradigm and using the EBP process.

Implementation of the ARCC model is accomplished through a 12-month program to prepare a cadre of EBP mentors who then work with direct care staff to implement and sustain EBP throughout the health care system. Evidence-based practice mentors are typically advanced practice nurses or transdisciplinary professionals or clinicians with bachelor's degrees. A series of 6 workshops with 8 days of educational and skills building sessions are conducted over the yearlong ARCC program, which is focused on implementing the 7-step EBP process and necessary strategies for building an EBP culture. Major content of the ARCC workshops includes (*a*) EBP skills building; (*b*) creating a vision to motivate a change to EBP; (*c*) transdisciplinary team building and effective communication; (*d*) mentorship to advance EBP; (*e*) strategies to build an EBP culture; (*f*) quality improvement processes; (*g*) data management and outcomes monitoring/evaluation; and (*h*) theories and principles of individual behavior change and organizational change. Before the first workshop, a baseline assessment is conducted to assess the clinicians' EBP beliefs, EBP implementation, organizational culture and readiness for EBP, job satisfaction, and group cohesion. Patient data on problems identified for improvement by the clinicians in the ARCC program are also collected and analyzed. Each team that is attending the series of workshops implements an EBP implementation project during the course of the 12-month program focused on improving quality of care, safety, and/or patient outcomes. Examples of projects and outcomes from the most recent implementation of the ARCC model at the Washington Hospital Healthcare System, a 355-bed community hospital system in the Western region of the United States, include the following: (*a*) Early ambulation in the ICU

resulted in a reduction in ventilator days from 11.6 to 8.9 days and no ventilator-associated pneumonias. (*b*) Pressure ulcer rates were reduced from 6.07% to 0.62% on a medical surgical unit. (*c*) Education of patients with congestive heart failure led to a 14.7% reduction in hospital readmissions. (*d*) Seventy-five percent of parents perceived the overall quality of care as excellent after implementation of an evidence-based family-centered care program compared with 22.2% before implementation.

MAJOR FACTORS INFLUENCING ADOPTION OF EVIDENCE-BASED PRACTICES

There are a number of factors that can influence the adoption of EBPs. Some of these factors include (*a*) the characteristics of the EBP (eg, the strength of evidence to support the practice, ease of administration, and cost); (*b*) characteristics of the clinician (eg, the understanding and cognitive beliefs/confidence to implement it and self-efficacy; (*c*) the environment and culture of the organization; and (*d*) the process through which the change is implemented (eg, consensus building and use of EBP mentors and opinion leaders).[35,36] These same factors are likely to exist when applying concepts from HROs in health care organizations. For clinicians to implement best practices and concepts from HROs, it must be made easy and fun as they are overburdened with patient loads and competing priorities. In addition, routine recognition and appreciation for efforts should be built in on a regular basis to recognize individuals and teams for their efforts. Furthermore, building EBPs and concepts from HROs into electronic medical records may help improve quality of care and patient safety, but too many reminders may lead clinicians to ignore them.

CONCLUSION

Concepts from HROs are being built into health care systems both to improve quality of care and patient safety and to improve efficiency and reduce health care costs. Substantial overlap exists in building HRHOs and EBP cultures. Implementation of the ARCC model for systemwide implementation and sustainability of EBP can assist organizations in achieving high reliability.

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