

# **The Science Behind Health Information Technology Implementation: Understanding Failures and Building on Successes**

**Kim M. Unertl, PhD, Laurie L. Novak, PhD, Cindy S. Gadd, PhD, Nancy M. Lorenzi, PhD  
Vanderbilt Implementation Sciences Laboratory, Department of Biomedical Informatics,  
Vanderbilt University School of Medicine, Nashville, TN**

## **Abstract**

*Everyone attending the AMIA conference has likely either heard about or had firsthand experience of a failed health information technology implementation. The line dividing failed implementations from successful ones frequently seems perilously thin, dependent on people and organizational factors as much as on technology design. What implementation lessons have informatics researchers and practitioners learned from prior failures and successes? Can the research domain of Implementation Science assist practitioners to improve implementation planning and execution? Implementation Science draws on multiple disciplines and perspectives (e.g., clinical, organizational, engineering, behavioral, social science) to understand technology adoption, explore patterns of technology use, and define organizational strategies for sustainable deployment. Through two case study presentations and a series of questions, our presentation will actively engage the audience in a discussion of what an evidence-based approach to implementation might mean at different institutions and explore practical implications of Implementation Science for decision-makers and technology implementers. The presentation will translate research on implementation into implementation lessons and practical strategies for practitioners.*

## **Introduction and Background**

Working in organizations, we all can appreciate the complexity of organizational life. Having local knowledge can play a critical role in “getting things done” and even a seemingly straightforward change can fail to produce intended outcomes. Despite this practical knowledge, research on health information technology (HIT) implementation often seeks to cordon off these complex organizational and contextual characteristics because they are difficult to characterize and frequently impossible to quantify. A growing number of researchers argue that instead of isolating the context in which technology is used, understanding and characterizing organizational and contextual sources of variation is critical to developing an evidence-based approach towards HIT implementation[1-5].

Implementation Science is the study of how to optimize deployment of new technology and practice innovations within existing and new work environments. While this area of study can produce many theoretical explorations of implementation strategies, it can also provide practical insights for organizational leaders. One of the most significant challenges in implementing new technology is understanding how to integrate innovative and potentially disruptive new technology within existing work practices and organizational structures. There is no single “one size fits all” approach to technology implementation. Implementation Science explores the key organizational levers that enable success in technology implementation. These organizational levers include technology deployment strategies[6], state of the art methods for understanding work[5], and robust strategies for evaluating technology impacts[7].

## **Case Study 1: Bar Coded Medication Administration**

The implementation of new information technology in the clinical setting can be disruptive to existing patterns of work. This case study will explore the implementation of barcode medication administration (BCMA) in the inpatient setting[8]. Using lessons from our empirical research and from the literature, a range of barriers to effective BCMA implementation will be explored, including issues in the following domains:

1. System architecture and design
2. Rollout, training and support
3. Organizational policy and management actions

With this case, participants will be encouraged to explore resources and constraints in their own environments to proactively identify potential implementation landmines, not only for BCMA, but also for other health IT applications and organizational change initiatives.

## **Case Study 2: Technology-Supported Collaborations Across Organizations**

Achieving coordinated care delivery in the current fragmented healthcare system requires sharing health information across organizational boundaries[9,10], a challenge due to disparate HIT systems[11,12]. Technology-supported[13-15] and Federally-funded[16] health information exchange pilots are beginning to provide greater cross-organizational access to patient health information. This case study will explore implementation of health information exchange technology in multiple organizations and in hospital- and clinic-based environments[17]. Drawing on our research and from the literature, we will explore:

1. How decisions made during implementation of health information exchange technology impact adoption and long-term success
2. The interaction among technology design, implementation planning, and technology adoption
3. Developing technology implementation plans for diverse environments

With this case, participants will be encouraged to explore the implications of implementing health information exchange technology within their own organizations, to identify best practices for implementation in their environment, and to consider potential organizational risks of technology implementation.

### **Implementation Questions**

Throughout our presentation, we will utilize several key questions to organize our case study presentations and encourage discussion with the audience.

1. What is the most critical barrier to implementation of new technology in your organization? What is the most helpful facilitator to implementation in your organization?
2. Do other members of your healthcare team (e.g., physicians, nurses, medical assistants) have different barriers and facilitators to technology implementation than you do? How involved in implementation are your end users?
3. What types of implementation plans has your organization developed in the past?
4. What elements of past implementations at your organization have been successful? What elements have failed?
5. Have you evaluated the effectiveness and efficiency of your previous technology implementations? If so, what methods have you used?

Using these questions, we will help participants understand how Implementation Science applies to their organizational contexts and provide new ways of thinking about implementing HIT using evidence-based recommendations.

### **Implementation Lessons**

Research in the Implementation Science field offers multiple insights with practical implications for informatics practitioners, our presentation will focus on the following five implementation lessons.

1. Developing an implementation plan for new technology is critical for long-term success.
2. Implementation plans should integrate workflow assessment and planning for technology evolution.
3. Combining qualitative and quantitative methods when assessing the implementation process can lead to actionable insights.
4. With appropriate engagement techniques, end users can contribute significantly to realistic and manageable implementation plans.
5. Different organizational and work group characteristics may require different implementation strategies.

Discussing these five lessons with respect to both case studies and other examples from the literature and experience will provide practical insights on implementation strategies for HIT.

## Specific Educational Goals

1. Define what the term “Implementation Science” means.
2. Understand how planning for technology implementation impacts potential success or failure of an informatics project and long-term adoption of HIT.
3. Examine evidence-based approaches to technology implementation: what implementation strategies have led to successful technology adoption, how research on implementation can help teams implementing technology, and research-based strategies for dealing with implementation problems.

## Who Should Attend

CMIOs, CIOs, Physicians, Nurses, Individuals responsible for technology selection and implementation, Researchers interested in learning more about technology implementation

## References

- 1 Aarts J, Doorewaard H, Berg M. Understanding implementation: the case of a computerized physician order entry system in a large Dutch university medical center. *J Am Med Inform Assoc* 2004;**11**:207–216.
- 2 Berg M. Implementing information systems in health care organizations: myths and challenges. *Int J Med Inform* 2001;**64**:143–156.
- 3 Greenhalgh T, Potts HWW, Wong G, *et al*. Tensions and paradoxes in electronic patient record research: a systematic literature review using the meta-narrative method. *Milbank Q* 2009;**87**:729–788.
- 4 Kaplan B, Shaw NT. Future directions in evaluation research: people, organizational, and social issues. *Methods Inf Med* 2004;**43**:215–231.
- 5 Unertl KM, Novak LL, Johnson KB, *et al*. Traversing the many paths of workflow research: developing a conceptual framework of workflow terminology through a systematic literature review. *J Am Med Inform Assoc* 2010;**17**:265–273.
- 6 Novak L, Brooks J, Gadd C, *et al*. Mediating the intersections of organizational routines during the introduction of a health IT system. *Eur J Inf Syst* 2012;:–.
- 7 Johnson KB, Gadd C. Playing smallball: approaches to evaluating pilot health information exchange systems. *J Biomed Inform* 2007;**40**:S21–6.
- 8 Novak LL, Novak LL, Lorenzi NM. Barcode medication administration: supporting transitions in articulation work. *AMIA Annu Symp Proc* 2008;:515–519.
- 9 Bodenheimer T. Coordinating care--a perilous journey through the health care system. *N Engl J Med* 2008;**358**:1064–1071.
- 10 O'Malley AS, Grossman JM, Cohen GR, *et al*. Are electronic medical records helpful for care coordination? Experiences of physician practices. *J Gen Intern Med* 2010;**25**:177–185.
- 11 Brailer DJ. Interoperability: the key to the future health care system. *Health Aff (Millwood)* 2005;**Suppl Web Exclusives**:W5–19–W5–21.
- 12 Kuperman GJ. Health-information exchange: why are we doing it, and what are we doing? *J Am Med Inform Assoc* 2011;**18**:678–682.
- 13 Frisse ME, King JK, Rice WB, *et al*. A regional health information exchange: architecture and implementation. *AMIA Annu Symp Proc* 2008;:212–216.
- 14 McDonald CJ, Overhage JM, Barnes M, *et al*. The Indiana network for patient care: a working local health information infrastructure. An example of a working infrastructure collaboration that links data from five health systems and hundreds of millions of entries. *Health Aff (Millwood)* 2005;**24**:1214–1220.
- 15 Goroll AH, Simon SR, Tripathi M, *et al*. Community-wide implementation of health information technology: the Massachusetts eHealth Collaborative experience. *J Am Med Inform Assoc* 2009;**16**:132–139.
- 16 Blumenthal D. Launching HITECH — NEJM. *N Engl J Med* 2010.
- 17 Unertl KM, Johnson KB, Lorenzi NM. Health information exchange technology on the front lines of healthcare: workflow factors and patterns of use. *J Am Med Inform Assoc* Published Online First: 14 October 2011. doi:10.1136/amiajnl-2011-000432