Using Public Health Evaluation Models to Assess Health IT Implementations

September 2011



White Paper

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Healthcare Information and
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Abstract

Essential elements of public health program evaluation can be applied to the evaluation of health information technology (health IT). Integrating the framework of public health evaluation with existing best practices in health IT evaluation can yield a more robust set of methods within a proven framework than either alone. This combined approach is of particular importance given the rapid pace of health IT implementation due to funding from the American Recovery and Reinvestment Act (ARRA) of 2009. In this paper, we outline the importance of evaluation in health IT, elements of public health program evaluation, and special considerations for health IT. We review the Centers for Disease Control and Prevention's (CDC's) public health evaluation model and how it can be adapted and applied to assessments of health IT applications.

Introduction

Evaluation, or systematically investigating the merit, worth, or significance of an object of study (Scriven, 1998; Shadish, Cook, & Leviton, 1991), is often overlooked in the course of daily operations, especially in a fast-paced, complicated intervention such as implementing an information system. However, much can be learned from conducting evaluations and analyzing findings, the results of which may be used to improve existing systems and inform implementation of future ones.

Taking time to systematically assess and improve health information systems is critical, given that the adoption and use of health IT has been increasing steadily. Several factors have led to this change. One is the introduction of the Electronic Health Record (EHR) Incentive Program, which pays eligible providers and hospitals who meet explicit functional and quality measures related to EHRs and thereby achieve "meaningful use" of these systems (Centers for Medicare & Medicaid Services, 2011; Office of the National Coordinator for Health Information Technology, 2011). Another is the promise of technology to improve patient safety and quality. Regardless of the reason, health IT adoption has been swift relative to the past. And, while the widespread adoption and use of health IT is likely to provide a range of clinical, financial, and operational benefits to different stakeholders across the healthcare system, evaluation of the impact of health IT is at times overlooked.

The Case for Health IT Evaluation

Health IT is a tool that providers can use to improve the care they provide, as well as to improve the efficiency of clinical and administrative aspects of providing that care. To implement health IT more effectively in organizations, evaluation can be used to help adopters learn from previous implementations. Evaluation provides a systematic way to review the implementations, distill the results, avoid barriers and mistakes, and optimize system usage.

Evaluation of health IT implementations is important for a variety of reasons. First, those who funded the health IT implementation are interested in the return on investment, including quality and safety gains, improved satisfaction, operational efficiencies, and cost savings. Second, evaluations help us plan for future adoptions of technology, because any lessons learned can help future endeavors go more smoothly. Third, evaluations are a necessary component for a practice that wants to continuously improve its operations and learn how to use the technology to its fullest capacity. For example, EHRs promise to provide practices with a wealth of new information, from knowing which patients are up-to-date on their immunizations and screenings to knowing how many patients with diabetes in a practice have their blood sugar (HbA1c) under control. Continuous evaluation will help providers transform the data and information about their practice into knowledge that can improve both encounters with individual patients and population-based care practices.

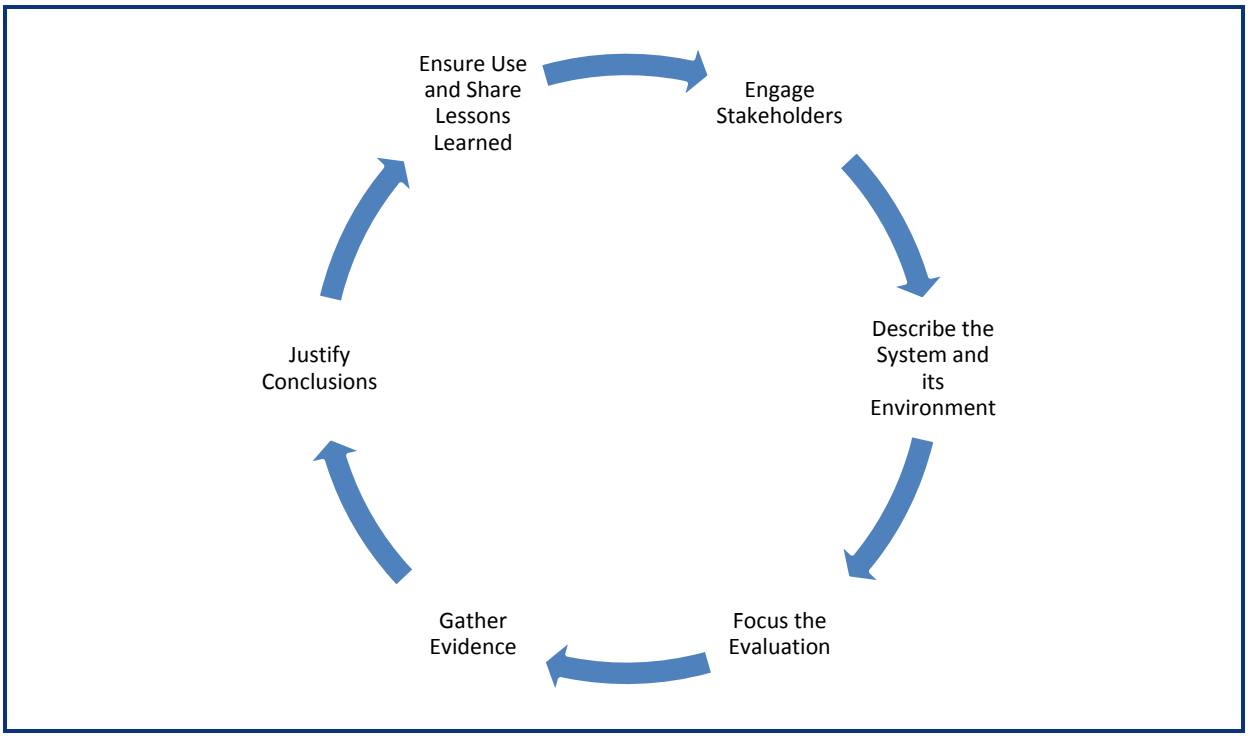
Applying Public Health Evaluation to Health IT Implementations

As in health IT, public health program evaluation serves a major role in justifying expenditures and providing lessons learned. This important function has created a tradition of frequent evaluation in public health practice, providing a plethora of opportunities to refine the evaluation models used in the field. CDC's Framework for Program Evaluation (Koplan, Milstein, & Wetterhall, 1999) has been used for many years by evaluators of public health programs. In this paper, we have adopted this framework to make the model relevant to evaluators of health IT. These guidelines provide a suitable framework for health IT evaluation that has been time-tested and used for a variety of different interventions. Because health IT evaluation has a shorter history, we can learn from the longer history of public health evaluation and use that as a framework to integrate similar efforts in health IT evaluation.

Steps for a Successful Evaluation

There are many factors to consider when conducting an evaluation. Figure 1 outlines the steps in a successful evaluation. The model is depicted in a circle because evaluation is not a one-time event, but an ongoing process for continuous improvement of systems and associated processes. As part of this overall improvement strategy, an initial evaluation may be conducted immediately after systems implementation to verify that the system works, followed by more detailed evaluations when the system is more fully deployed.

Figure 1. Steps in Conducting a Health IT Evaluation using CDC's Public Health Evaluation Model



Source: Adapted from CDC, 2011a.

The following is a review of the evaluation steps and how they would apply to a health IT evaluation:

1. Engage Key Stakeholders
2. Describe the System and its Environment
3. Focus the Evaluation
4. Gather Evidence
5. Justify Conclusions
6. Ensure Use and Share Lessons Learned

More information about the framework and associated resources can be found at CDC's program evaluation site (CDC, 2011b).

Engage Key Stakeholders

Stakeholders should be identified so that they can be involved in determining the focus of the evaluation. This is important because system implementation is interdisciplinary so soliciting a variety of perspectives can help improve the evaluation. Possible stakeholders include:

- those involved in system operations (funders, vendors, IT staff);
- end users of the system (various clinicians, administrative and billing staff); and
- those served or affected by the system (public health officials, patients, community advocates, quality improvement, risk management).

While it is important to identify all stakeholders, not all of them will be engaged in the evaluation process. The level of involvement will depend on factors such as the goals of the evaluation and the status of system implementation. Stakeholders should be engaged in the decision-making process as soon as it is determined that an evaluation will be conducted. Each of them will have their own goals and focus, and not all of these will make it into the evaluation. If it becomes difficult to reach a consensus, organizational leadership may need to intervene and identify priorities.

Some organizations choose to have external parties conduct the evaluation for them, to provide an objective perspective. The external party can then facilitate the steps of the evaluation and help mediate conflicts between stakeholders.

When conducting an initial evaluation of a newly adopted electronic health record (EHR) system in a primary care practice that has transitioned from paper records, these steps may occur as follows.

1. Engage Key Stakeholders

These might include patients, the physicians in the practice, physicians to whom the practice refers, nurses, support staff, and administrators.

2. Describe the System and its Environment

This includes a description of practice characteristics, the patient population and their needs, staff skills and needs, operations, goals, workflows, resources, and reporting structures, among other things.

3. Focus the Evaluation

At this stage, the practice is primarily concerned with whether the system has been implemented properly and staff are trained to use it.

4. Gather Evidence

The practice engages a Regional Extension Center (REC) to conduct interviews, shadow work processes, run system reports, and conduct a survey of stakeholders to more fully understand whether the promised system functionality is in place and staff are able to use it.

5. Justify Conclusions

The REC used a variety of methods based on the system itself and the people who used it. By integrating these methods into the analysis, the REC was able to justify the conclusions about the system.

6. Ensure Use and Share Lessons Learned

The REC was able to take the findings from the evaluation and provide areas where the practice could work with the vendor to improve system functionality. The REC also provided specific guidelines for training based on role. In addition to helping that specific practice, the REC used the findings to inform future system implementations.

Describe the System and Its Environment

The system and its goals should be described and outlined, including an understanding of the goals of implementation. Because systems are not implemented in a vacuum, this

description should include organizational factors such as the purpose of the system, what it is expected to do, what clinical and administrative workflows will be affected, expected downstream and reporting changes, and what resources are needed. It should also include the degree of sophistication of the system and the stage of implementation. For example, a system that is in the midst of being implemented will have different evaluation criteria than one that is in fully operational. It is important to draw from multiple sources of information for this description.

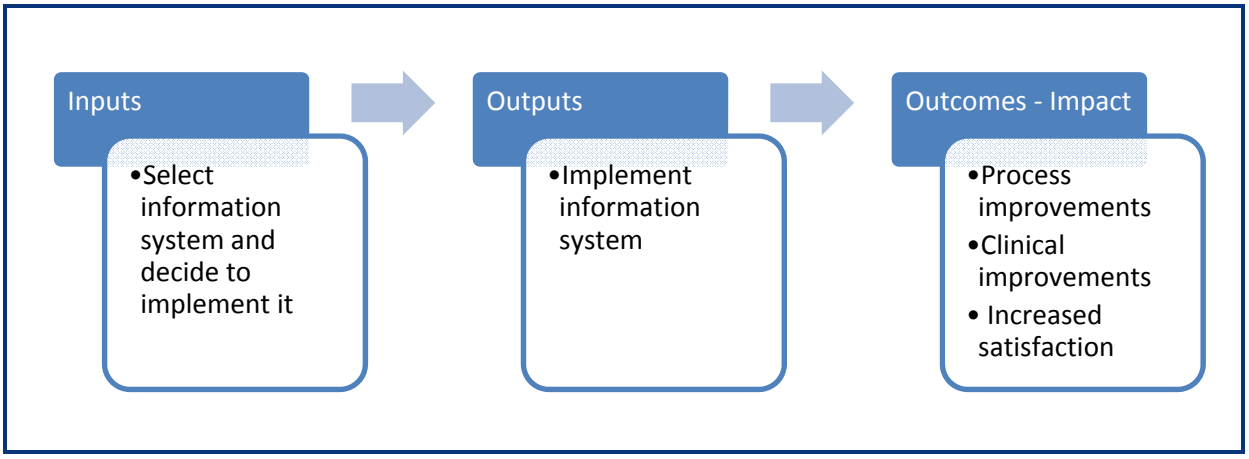
Once the system is understood, a logic model of inputs, outputs, and impacts can be developed to show the connections between the current state and the desired end state (University of Wisconsin-Extension, 2003). For health IT, this information is useful to help stakeholders understand the current state, what the system will change, and the impact of those changes. This process occurs through outlining inputs, outputs, and outcomes:

- Inputs—resources to help achieve desired outputs (information system)
- Outputs—activities conducted to reach the targeted participants (implementation of the system)
- Outcomes—changes or benefits in the short and long term (changes as a result of the information system's implementation)

The depiction should demonstrate how inputs result in outputs that change outcomes.

Figure 2 presents a simple logic model as an example to demonstrate how a model might look for an information system implementation.

Figure 2. A Simple Logic Model for EHR Implementation



Source: Adapted from University of Wisconsin-Extension, 2003.

This figure provides a strong visual for understanding not only where an organization is in the system lifecycle, but the impacts of process measures and successes on outcome measures and successes. It also provides information for how to select intermediate measures when final measures might not be available or easily collected.

Focus the Evaluation Design

A given evaluation cannot focus on every aspect of an implementation. Thus, each evaluation must have a **focus and purpose**. Ives, Hamilton, and Davis (1980) and Kraemer and Dutton (1991) propose a categorization of research and evaluation of information systems:

- external environment of the organization
- internal environment of the organization
- information system users
- systems development environment and staff
- management and operational environment of the system
- nature of the system including information processed
- patterns of utilization
- organizational impacts
- social impacts

For health IT the evaluation could include questions about qualities such as the following:

- the system itself
- use of the system
- results of the system
- changes in outcomes before and after the system
- cost-effectiveness of the system
- user training
- changes in interdepartmental interaction
- reduction in adverse events
- change in organizational processes
- satisfaction with the system
- downstream reporting
- privacy and security

Understanding the purpose will help drive how the evaluation should be conducted. In addition to the questions, the evaluator needs to consider where the system is in its maturity. Often, evaluation questions will include properties of the system itself and how people interact with it. Organizational impacts also play a factor.

Once the purpose is defined and agreed upon with stakeholders, the specific bounds of the evaluation must be identified, along with a definition of what the evaluation is trying to investigate. The **questions to evaluate** will naturally flow from the purpose. Referring back to the logic model can help to clarify the questions as well. The Agency for Healthcare

Research and Quality (AHRQ) has a variety of measures and suggested data sources that can provide a starting point for this step (AHRQ, 2011).

Once the questions are identified, the **methods** for evaluation can be decided. The methods should be varied and tailored to the questions (Friedman & Wyatt, 2004) and can include both qualitative and quantitative approaches. Using a variety of techniques and approaches is particularly important when evaluating both organizational and technological aspects of systems (Anderson & Aydin, 2005). Friedman and Wyatt (2004) provide further information about methods and how to apply them for health IT evaluations.

To carry out the research, **agreements** about roles and responsibilities are needed, including who will carry out the activities of the plan, who will obtain access, how resources will be allocated, and any safeguards that are needed. Agreements may or may not be formal, yet they must be discussed and decided by the stakeholders so that expectations are clear. If the purpose of the evaluation goes beyond internal use, Institutional Review Board oversight might be required to ensure protection of human subjects as well.

Gather Evidence

The design of the evaluation and methods selected will inform data collection and analysis. Considerations in data collection include the information that will be used and where it will come from. Information can come from system reports, user experiences with the system, or other organizational indicators. Specific evidence will be informed by the design and methods.

Data that are collected must then be analyzed. While using multiple sources of data can make analysis challenging, it also results in a more robust evaluation. The methods to be used in gathering evidence depend on the evaluation question and how the system is viewed (Anderson & Aydin, 2005). Some view an information system as an external force thrust upon an organization. Others view systems as determined by user information needs. Another approach is to consider complex social interactions as determinants of system use. Whether the model of how a system enacts change is considered to be an external force, one based on user needs, or one based on interactions will help determine how questions will be studied. Table 1 outlines a list of questions, the model of change for each, and suggested methods to obtain evidence to support answering the questions.

Justify Conclusions

In this phase, the evaluator takes the evaluation questions outlined earlier and attempts to answer them with the evidence collected during data collection. Data analysis can be used to make and justify conclusions, including comparison of results against some standard, analysis and synthesis of information, interpretation of results, judgments about success of the system, and recommendations for the future.

Table 1. Evaluation Questions, Models of Change, and Suggested Research Methods

Evaluation Question	Models of Change	Suggested Methods
Does the system work as designed?	External force User needs Interactions	Various qualitative, survey, cognitive approaches, work sampling
Is the system used as anticipated?	External force User needs Interactions	Various qualitative, survey, internet survey, cognitive approaches, work sampling
Does the system produce the desired results? Were there any unexpected results?	External forces User needs Interactions	Various qualitative, survey, work sampling
Does the system work better than the procedures it replaces?	External force User needs	Various qualitative, survey, cognitive approaches, work sampling, simulation
Is the system cost-effective?	External force User needs	Work sampling, simulation
How well have individuals been trained to use the system?	External force User needs	Various qualitative, survey, cognitive approaches
What are the anticipated long-term impacts on how departments interact?	Interactions	Various qualitative, survey, network analysis
What are the long-term effects on the delivery of medical care?	User needs Interactions	Various qualitative, survey, work sampling
Will the system have an impact on control in the organization?	Interactions	Various qualitative, survey, network analysis
To what extent do impacts depend on practice setting?	Interactions	Various qualitative, survey
What are the impacts on the health care system at large?	Interactions	Various qualitative, survey, Internet survey
How will the system affect patient safety?	Interactions	Various qualitative, survey, cognitive approaches
How easy to use is the system?	Interactions	Various qualitative, survey, cognitive approaches

Source: Adapted from Anderson & Aydin, 2005.

Conclusions may be stratified by type of change that results from implementation. These changes can include both operational and clinical work practices. Anderson and Aydin (2005) propose the following categories of change due to introduction of a system:

- changes to individuals and how they do their jobs
- changes to departments as a whole and how their work is performed
- changes to the structure and functioning of the organization in which the system was implemented
- quality of service and medical care received

Shaw (2002) proposes a different way of categorizing impacts of a system. The CHEATS model emphasizes the following aspects:

- clinical
- human and organizational
- educational
- administrative
- technical
- social

When developing conclusions and using evidence to justify them, it is important to stratify them across the above aspects. This will help in communicating to the appropriate stakeholders so that they understand which conclusions are most relevant to them.

Ensure Use and Share Lessons Learned

Conclusions must be disseminated so that the lessons can be used to inform other implementations within and outside the organization. In addition, evaluation results can be used to improve existing implementations. The elements to be considered are design, preparation, feedback, follow-up, and dissemination. It is important that health IT evaluations be used to improve not only the technical aspects of the system, but the environment in which the system is housed. These factors include workflow, organizational structure, and communication patterns. Incorporating multiple perspectives is important in ensuring that we learn from evaluations on a broad scale (Kaplan & Shaw, 2004).

Using categorizations as identified earlier can help to facilitate sharing. Often, evaluations result in a great deal of data. It can be difficult to parse through that information and identify areas of improvement. Thus, it is important for the evaluator to consider the different stakeholders and what they can learn from the evaluation. By taking the CHEATS model and Anderson and Aydin's categorization of types of change, the evaluator can develop customized lessons learned for internal and external use. The evaluation can then guide future efforts to improve systems within the organization and to implement systems for those outside the organization.

Conclusion

Evaluation of health IT implementations is extremely important. Not only can evaluation help to improve individual implementations, but it can provide lessons learned and frameworks to inform future implementations. In addition, looking at health IT implementations more broadly can help us develop and refine best practices for implementations. In this paper, we have described a model for health IT evaluation based on CDC's framework for public health program evaluation. Building on many years of rigorous evaluation methodology development, this framework may guide health IT evaluators toward a more systematic approach. Although evaluations can be conducted in a variety of ways, the framework described here will assist in determining the appropriate

approach for the type of evaluation desired. Organizations should consider seeking outside assistance with evaluation to ensure an objective perspective and to take advantage of external expertise.

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