Using Diffusion of Innovation Concepts to Enhance Implementation of an Electronic Health Record to Support Evidence-based Practice

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The article identifies the explosion of clinical data that are available and how difficult it is for clinicians to find answers to clinical questions. Electronic healthcare records (EHRs) are increasingly used to assist clinicians in this process; however, resistance to the implementation of technology-assisted care is not uncommon. The article reviews the diffusion of innovation research and provides the nurse manager with suggestions for applying these concepts to enhance the implementation of an EHR that can support evidence-based practice. Five characteristics of innovations, as perceived by individuals, are discussed as they help explain different rates of adoption. The innovation-decision process is studied as it relates to EHR implementations. Key words: change, electronic health record, evidence-based practice, innovation

It is a well-known fact that an average of 195,000 people in the United States died because of potentially preventable, in-hospital medical errors in each of the years 2000, 2001, and 2002 according to a study of 37 million patient records. In response, Dr Samantha Collier stated, “the equivalent of 390 jumbo jets full of people are dying each year due to likely preventable, in-hospital medical errors, making this one of the leading killers in the U.S.”

A growing field of evidence supports the use of health information technology (IT) to enhance patient safety and improve quality and continuity of care. Dr David Brailer, National Health Information Technology Coordinator, indicated in a recent interview with Nicole Taylor that nurses are often “early adopters” and have a key role in steering the healthcare industry to achieve these goals.

In fact, Dr Brailer reported that his office’s goals for health IT cannot be achieved without nurses.

As healthcare providers and organizations move toward improving patient care, increasing the use of technology is more and more recognized as a way to achieve this goal. The integration of electronic healthcare records (EHRs), and the incorporation of the powers of the Internet, provides clinicians with new and effective tools to enhance patient care. With around-the-clock access to their organization’s clinical data warehouse, and a worldwide network of online clinical resources, healthcare providers can seek 24/7 clinical support for decision making whether they are in a clinic examination room, at the hospital bedside, or in a patient’s home.

CLINICIAN INFORMATION-SEEKING NEEDS

It is useful to examine the information-seeking needs of clinicians when considering...
the adoption of an EHR as a tool to enhance patient care and to improve clinical decision making.\textsuperscript{4} The research in this area is limited, although informative. Covell et al.\textsuperscript{5} found that internal medicine clinicians needed clinical information approximately twice for every 3 patients seen. A study by Gorman, as reported by D'Alessandro et al.\textsuperscript{6} found that rates of information needs varied from 0.013 to 5.044 questions per patient encounter.

Unfortunately, clinicians encounter numerous obstacles when accessing information, and the lack of time is one of the most common.\textsuperscript{6,7} Other obstacles include a lack of knowledge about appropriate answer sources and a reliance on convenient information sources, even when more appropriate resources may have been available.\textsuperscript{8} In addition, even with the availability of information, Ely et al.\textsuperscript{7} reported that clinicians found inadequate synthesis of multiple bits of evidence that were presented in a clinically useful statement.

It is not surprising that it is difficult to find specific pieces of information to answer clinical questions because the amount of clinical data that must be explored can be overwhelming. The National Library of Medicine indexes approximately 500,000 articles annually to add to the MEDLINE database.\textsuperscript{9} These new items are added to the existing 11 million articles from approximately 4600 of the world's preeminent biomedical journals that have been indexed since 1966.

With the rapidly expanding wealth of data, it is difficult for healthcare providers to keep current. Research indicates that physicians incorporate the latest medical evidence into their treatment decisions about 50% of the time.\textsuperscript{10} When identifying a gap in knowledge, clinicians must decide whether to do the best they can with their current knowledge or to expand that knowledge by formulating and answering a question.\textsuperscript{7} In a busy work environment, doing the best one can is often the only practical approach. Providing clinical decision support systems that are easily accessible and reliable is a strong contributing factor that may encourage clinicians to seek information to unanswered questions, rather than relying on their current knowledge.

**DIFFUSION OF INNOVATION**

When healthcare organizations consider the adoption of technology to assist clinicians in the provision of care, a question often arises—"If we build it, will they come?" The answer, unfortunately, is "not necessarily."

Everett Rogers has studied the diffusion of innovation for over half a century. Managers may be familiar with Rogers' categorization of individuals into groups on the basis of the time they begin using a new idea, for example: (1) Innovators, (2) Early adopters, (3) Early majority, (4) Late majority, and (5) Laggards. Although these categories are applicable in EHR implementations, this author decides to examine another part of Rogers' work—the innovation-decision process—in search of ideas to support the nurse manager.

Rogers tells us that even when a new idea has obvious advantages, it is difficult to get it adopted. He noted that innovations may take many years from the time they become available until they are widely adopted.\textsuperscript{11} Unfortunately, organizations may not have years to achieve adoption. In the author's experience, an accelerated timeline for the adoption of EHRs is frequently established by senior leadership because a positive return on investment is one of the desired outcomes. Thus, organizations generally have a vested interest in speeding up the rate of diffusion. Although focus is often placed on the hardware and software systems that will be required to support the innovation, much less attention is given to the social systems—the people—that will be incorporating these new ideas into their daily work.

Rogers defines diffusion as the process in which an innovation is communicated over time among the members of a social system. He indicates that what differentiates this type of communication from others is that the
message will always contain a new idea. He suggests that there are 5 characteristics of innovations, as perceived by individuals, that help to explain different rates of adoption:\(^\text{11}\):

1. **Relative advantage:** The perceived value that the innovation is better than the idea it supersedes. A greater perceived relative advantage of an innovation will result in a more rapid rate of adoption. Rogers notes that it does not matter whether an innovation has a great deal of “objective” advantage, but that it has “perceived” advantage for the adopter. Even potential adopters of innovations that are evidence-based will undergo a lengthy period of negotiation as its meaning is discussed, contested, and reframed.\(^\text{12}\) Although an EHR may lead to safer patient care, enhanced revenue capture for an organization, and improved communication among healthcare teams, it is important for the nurse manager to assist each individual in answering the question “What is in it for me?”

2. **Compatibility:** The degree to which individuals perceive the idea to be consistent with their values, past experiences, and needs. Many clinicians have experienced failed implementations of electronic healthcare-related systems, either as participants or as reported by their social network of peers. Therefore, perceptions of “here we go again” may interfere with a successful adoption and are difficult to overcome.

3. **Complexity:** The perceived difficulty of understanding or learning to use the new idea. Innovations that require the development of new skills and understandings will be adopted more slowly than ones that do not hold this requirement. EHR implementations require significant learning because they are complex, multifunctional systems. The adopter must not only learn the software mouse clicks and keystrokes needed to perform his or her work but also learn and integrate newly designed or modified workflows that are necessary to provide patient care that is supported by technology. Therefore, the complexities of EHRs are significant factors that affect the rate of adoption.

4. **Trialability:** The degree to which an individual has an opportunity to experience an innovation on a limited basis. Implementing an EHR on a trial basis is frequently not an option in a healthcare environment. However, implementing a project in a phased approach may offer individuals an opportunity to work with smaller sections of an application. Their experiences will, hopefully, demonstrate the advantages of implementing a technology-assisted system, will enhance their perception of the system’s values, and will decrease the complexity because it is unnecessary to learn the entire application at one time.

5. **Observability:** The degree to which an innovation’s results are visible to others. Rogers reports that when individuals can see the results of an innovation, they will be more likely to adopt it. Organizations frequently follow 2 different approaches when implementing EHRs. These are commonly referred to as a “big bang” approach when a large number of individuals/departments “go live” on a particular day, or a phased approach where departments go live on an incremental basis, often over a number of months. The incremental approach offers opportunity for individuals to observe the successes and challenges of prior departments.

William Marsh, MD, created the helpful acronym “TACOS” to easily recall Rogers’ key attributes.\(^\text{13}\) In addition, his colleagues succinctly summarized the attributes with a readiness question\(^\text{14}\):

1. **Trialability:** Will we be able to try this on a small scale first?
2. **Advantage:** Will the practice make things substantially better than they are now? Is this an important goal for the unit?

3. **Compatibility:** Will the practice work in our environment/culture?

4. **Observability:** Are there obvious and believable results for this practice? Can we see the practice in action at another site?

5. **Simplicity:** How big a disruption/change will this be?

Now that we have examined the 5 characteristics of innovation, let us focus on the process individuals (and decision makers) go through as they decide to accept or reject an innovation.

### THE INNOVATION-DECISION PROCESS

The innovation-decision process is one that individuals and other decision makers go through as they move from gaining initial knowledge about an innovation, form their attitude about the innovation, make a decision to adopt or reject the innovation, implement the new idea, and, finally to confirm their decision. Rogers indicates that this process deals with the uncertainty that is involved in deciding whether a new idea should be accepted and incorporated into one’s ongoing practice. He further points out that the perceived newness of an innovation and the uncertainty associated with it is a distinctive aspect of innovation decision making in comparison with other types of decision making.

This process occurs over time, and Rogers has developed a model that consists of 5 stages. These apply to individuals and to other “decision-making units” as he calls them:

1. **Knowledge** occurs when individuals or other decision-making units are exposed to the existence of an innovation and they gain understanding of its functionality.

2. **Persuasion** occurs when individuals or other decision-making units form either a favorable or an unfavorable attitude about the innovation.

3. **Decision** takes place when individuals or other decision-making units engage in activities that lead to their choice to either adopt or reject the innovation.

4. **Implementation** occurs when individuals or other decision-making units incorporate the new idea and begin using it.

5. **Confirmation** occurs when individuals seek reinforcement regarding the decision they have already made. However, they may reverse their decision if they are exposed to conflicting messages about the innovation.

Each of these stages will be discussed as they relate to the implementation of an EHR to support evidence-based practice.

### Knowledge stage

Rogers describes 3 types of knowledge: (1) awareness-knowledge, (2) how-to knowledge, and (3) principles-knowledge. Awareness-knowledge is simply knowing that an innovation exists. Rogers notes that most change agents concentrate their efforts in creating this type of knowledge.

How-to knowledge involves understanding how to use the innovation correctly. In the case of a complex innovation such as an EHR, much how-to knowledge is required. Rogers found that when an adequate level of how-to knowledge was not obtained before and during the adoption of an innovation, rejection and discontinuance were likely to result.

The third knowledge type is principles-knowledge and deals with an individual understanding the underlying principles of how an innovation works. Rogers indicates that although it is usually possible to adopt an innovation without principles-knowledge, the ability of an individual to evaluate the effectiveness of an innovation is facilitated when he or she has this understanding.

Rogers suggests that change agents could play their most “distinctive and important” role in the innovation-decision process if they concentrated on the how-to knowledge. The author strongly supports this recommendation. Unfortunately, training is often placed...
near the bottom of an implementation project plan. In contrast, it deserves a prominent place prior to, during, and long after the diffusion of an innovation. In fact, training never stops. The organization that skimps on training during the diffusion of an innovation will end up paying for it in other ways. For example, if learners do not reach competency prior to a go live, training departments routinely report the need to provide significant 1:1 postimplementation support, and for a longer period than originally projected.

**Persuasion stage**

During the persuasion stage, an individual forms either a favorable or an unfavorable attitude toward the innovation. Rogers' meaning of persuasion does not refer to the process where a change agent attempts to persuade an individual to a desired outcome. Instead, during this stage Rogers notes that individuals become actively involved and seek information about the new idea, decide which messages are credible, and decide how they will interpret the information they have received.

Because all innovations involve uncertainty, it is during this phase that individuals will seek social reinforcement from others with similar attitudes to validate that their thinking is on the right track. The author has frequently interacted with individuals who are validating their attitudes when asked questions such as "Dr X is saying how difficult it is to chart, how it slows down the work of the clinic, and how he does not like the EHR. I know you have worked with the system for a long time and you have said that this has not been your experience. Tell me more, because I am looking forward to next year when our department finally gets to implement the EHR."

**Decision stage**

During this stage, an individual either adopts or rejects an innovation. Although uncertainty about the innovation's consequences remain, participating in a pilot study or partial trial may be useful. Interestingly, a decision to adopt may not always be sustained. Rogers calls this "discontinuance" when the acceptance of a previously adopted decision is now rejected.

**Implementation stage**

Implementation occurs when an individual uses an innovation. Ideally, this should closely follow the decision stage although, in the case of large implementations, this is generally not possible.

**Confirmation stage**

During the confirmation stage, individuals seek reinforcement for the decision they have already made. In some cases, they may reverse it if further information has become available, persuading them that the innovation should not have been adopted. In some situations, it is the organization that may decide to discontinue further implementation of the innovation.

It is during this stage that users change or modify the innovation to best meet their needs. This process is called "reinvention." If adopters can make these modifications, the innovation will be adopted more easily. Thus, the nurse manager can support end users by making sure that adopters have sufficient product knowledge, thus enabling them to make these modifications.

**GETTING BUY-IN**

Although organizations may spend millions of dollars to purchase new hardware and software, a key to the success or failure of the project is related to getting buy-in from the clinicians who will be using it. Therefore, a manager’s most important role may be to help his or her staff in answering the question “What is in it for me?” Each of us needs to identify those factors, first as they relate to ourselves, and then to our colleagues, to our organization, and perhaps, most important, to our patients.

Steven Ford, a general practitioner, summarized this concept so well in a letter to the editor of the *British Medical Journal.* The
grandness of the vision, the vastness of the expenditure, the shininess of the machines, the detail of the planning, the complexity of the systems, the rightness of the cause, the necessity of modernization, the face of the sponsoring politicians—none of these things signify if the users’ requirements are not met ahead of all other considerations.”

He further expressed, “Nothing counts except what is in front of the clinician in the thick of the action and what can be done with it.”

Kirkley shares this impression by suggesting that no matter how good a system is, unless the staff supports its use, it will not deliver results. She suggests that nurses will learn to work around systems they do not like, do not understand, or do not value. Timmons, in his study of nurses’ resistance to the implementation and use of computer systems, discovered that resistance took a variety of forms. He reported that nurses’ attempts to minimize or “put off” system use, criticize the system, and refusal to use the system (rare) were, in some cases, quite powerful, and called this “resistive compliance.”

Timmons found that nurses attempted to minimize use of the system as evidenced by neglected, incomplete, and delayed documentation in the care plan. Criticisms of the system included the following: (a) it was time consuming, (b) not enough terminals were available and resulted in a queue to use them, (c) the amount of care plan documentation tended to grow because it was easier than to handwrite, and (d) that the nurses could not concentrate for any length of time while documenting because they were constantly interrupted. Nurses reported that patients and relatives did not see using the computer as being “real work” and that it was acceptable to interrupt the nurse while she was documenting.

Moody et al described many of these same findings in their study that identified nurses’ needs, preferences, and perceptions associated with EHR documentation methods. Software and system problems were reported by 61% of respondents. Interruptions while documenting patient care were reported by 54% of respondents. A same number of respondents indicated they were using duplicate methods of clinical documentation because it was inconvenient to use the EHR at the bedside; thus, they took notes and transferred that information to the EHR later. Although nurses in this study had access to workstations in patient rooms, they reported that the rooms were too crowded and there were too many disruptions. In contrast, however, many nurses favored bedside documentation for the following activities: (a) vital signs (65%), (b) medications (62%), and (c) ongoing assessment and progress notes (62%).

Timmons reports that one of the most frequently occurring criticisms was of system reliability, that is, that it crashed, was slow to respond, and was not available when it was taken offline for maintenance of backups. In addition, nurses in this study did not have workstations at the bedside. Therefore, when they collected information from the patients at their bedside, for example, an admission assessment, they had to document on paper or retain information in their memory until they could reach a workstation.

ACKNOWLEDGE NURSING INVOLVEMENT

Unfortunately, nurses have frequently observed the attention healthcare administrators give to physicians to encourage their participation in IT initiatives because they are perceived to be the ones responsible for a successful implementation. Nurses then observe the “disconnect” that occurs when physicians are often the last group of clinicians to be brought online. For example, it is common for nursing staff to be involved in the first phase of an implementation while physicians either participate in a limited manner or join in during later phases. Kirkley suggests that the nursing staff members may be overlooked in the process of change management, even though they are the linchpins that hold everything together.

Kirkley further notes that nurses are responsible for the clinical documentation
on which many other clinicians' interactions with the system are based. With the immediacy of nursing documentation available to all clinicians and other professionals who are working with a patient, nurses may begin to appreciate that their documentation is crucial to the decisions of the entire healthcare team. This negates the common practice of documenting findings on a piece of paper that is carried around until end-of-shift documentation is performed. The advantages of real-time charting exemplify a what’s-in-it-for-me rationale that nurse managers can nurture.

This may be a difficult concept for the nurse manager to “sell,” however, until nurses truly see that their efforts are utilized by colleagues in clinical decision making. In fact, documenting in an EHR may, in some situations, take more time than documenting on paper. Kirkley and Stein¹⁹ suggest that if nurses in an organization have routinely saved time by submitting incomplete paper documentation, then the completeness of documentation ensured by a good technology implementation may actually take more time.

Physicians and nurses report that time inefficiency is recognized as a major barrier to successful EHR implementations.²⁰ Poissant et al²⁰ inform that the perception of end users for workflow and time efficiency in the clinical documentation process is an important concept in assessing EHR benefits, rather than the impact of the processes involved in care delivery. Clinicians, especially nurses, may neglect to consider the time they spent “hunting down the chart” or waiting while a colleague completed his or her charting in the paper-based world.

Data availability to support clinical decision making is significantly affected by the accessibility to the EHR for documentation. In one study, over half of the respondents reported interruptions while documenting patient care. EHR access at the bedside was an obstacle because patient rooms were too crowded and there were too many disruptions, and that they were using duplicate methods of clinical documentation. Because it was inconvenient to use EHRs at the bedside, nurses often recorded information on paper and transferred that to the electronic chart later.¹⁸

Ease of access to the EHR to support clinical decision making is a critical factor that can encourage the adoption of innovation. Organizations have responded to accessibility issues by purchasing rolling computer carts, using wireless and handheld devices, providing each nurse with a laptop, and installing workstations in patient rooms and/or hallways. Although it is too early to define “best practice” regarding the type of equipment to use, and in what situations, the nurse manager can ensure accessibility to the EHR as a critical consideration when capital expenditures are discussed, and can keep abreast of current literature and anecdotal input from organizations that have reported successful implementations.

CONCLUSION

Nurse managers play an important role in supporting the diffusion of innovation within their organizations. By understanding and responding to the needs of “potential” and, hopefully, permanent adopters of EHRs, the integration of technology can enhance patient safety and improve quality and continuity of care.

The author would like to close with a quotation that is attributed to Richard Hooker, a British theologian during the late 1500s, “Change is not made without inconvenience, even from worse to better.”²¹

REFERENCES


