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Impact of Health Information Systems on Organizational Health Communication and Behavior

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ABSTRACT

Information is critical in making health-related decisions. New communication technologies show great promise in providing ways to develop and deliver changes in health behaviors. The behavioral and communication changes in consumers, patients, providers, and organizations are being noticed at individual, community, and organizational levels due to innovations in electronic health information systems, such as personal health records (PHRs), electronic medical records (EMRs), and electronic health records (EHRs). The noted behavioral/communication changes include improved quality patient care; easy, accurate, and quick information retrieval; rapid information sharing; quick decision making; reduced medical errors due to electronic alerts; increased storage of data and records electronically; and improved information screening and reporting. Literature was reviewed using Pub Med and an internet search. Roger's 'Diffusion of Innovation Model' has been used in a variety of disciplines to understand how innovations are adopted and diffused in various cultures. In recent years, new developments have resulted in the rapid growth of communication technologies such as computer software, the Internet, email, mobile telephones, information systems, and handheld computers. Previously, computer use was predominantly available in high-level government agencies, research laboratories, and large companies. Today, computers and advanced technologies in connection with health data are the new way to manage diseases. Hospitals, healthcare organizations, health departments, and small healthcare facilities, are adopting health information systems and average citizens are using computers to access health-related information. User interfaces have improved and are being interactive with other information systems. The rate of adoption continues to increase as technology becomes cheaper and more accessible. This article discusses the effect of innovation in health information technology on the public's health communication and health behavior.

INTRODUCTION

The Internet has become a main source of information, and growing rapidly in the lowest income group of the population especially in African American and Hispanic families. In early years of 2000, families who were earning less than \$15000 per year adopted computers above the national average. Vast improvements in technological innovations in health communication reflect change in health behavior at every level.¹ Today, consumer-directed healthcare changes the health behavior of patients because of readily available access to their own information and easily manageable health data. In healthcare domain, health information systems such as personal health records (PHRs), electronic health records (EHRs), and electronic medical records (EMRs) are beneficial to the public at the individual, community, and organizational levels. Personal health records allow individuals to collect, view, manage, or share their health information electronically. Most PHRs are standalone systems but some are the components of EMRs. Electronic medical records are primarily intended for health care providers and are a set of databases that store the health information of patients (drug allergies, diagnoses, treatments, lab results, and medical history). EMRs are adapted to fit an organization's standards and clinical delivery processes, such as pharmacy data and preventive care delivery. Electronic health records have a similar structure to EMRs, but can be shared cross-institutionally to link data from

various providers to give a more comprehensive view of any single patient's health record and to facilitate interactions with the entire health system.

On February 17, 2009, President Obama signed into law the \$787 billion American Recovery and Reinvestment Act (ARRA) of 2009. This legislation allocates approximately \$34 billion dollars in stimulus money for health information technology.² As communication technologies improve many hospitals, clinics, and community health centers are installing electronic medical records. This includes advance clinical management systems to support the providers and personal health records to patients. Linking personal health records to electronic health records create a seamless electronic medical and health record. Another addition in the health information systems will be bio-monitoring communication devices. These bio-monitoring devices will automatically update the personal health record with information from the electronic medical records and electronic health records.¹ Patients and health providers will have access to powerful knowledge management with this new technology and its diffusion. This will help in patient-provider communication, patient care coordination, and decision support by healthcare providers. Only using EMR, physicians can deliver recommended care for many chronic diseases in approximately half of the time as compared to using traditional paper records. Physicians receive reminders and flags for adverse drug interactions, reminders of services to provide to the patients during routine visits, and patients can receive reminders to schedule follow-up care. Reminders to patients generated by EMR systems have shown increased patients' compliance with preventive care recommendations when the reminders are merely interjected into traditional outpatient workflows.³

MATERIAL AND METHODS

The Roger's 'Diffusion of Innovation Model' has been used in a variety of disciplines to understand how innovations are adopted and diffused in various cultures. The literature was reviewed using Pub Med and internet search. The current innovations in health information systems have improved the delivery of healthcare and also lowered the cost of health services. Studies show marked improvements in quality of care and medication errors, reductions in physician and nurse time, and improvements in practical experience and training for new physicians and medical students.⁴⁻⁶ Additional studies explain that patient demographics, medical, financial, and billing information can be obtained digitally anytime and anywhere.^{7,8} Researchers have investigated the perceived value people receive from personal health records, the receptiveness of patients accessing a doctor's electronic health record, and the usability of a patient-interface with an electronic medical record.^{9,10} The common findings from these studies include respondents rating usability and functionality quite favorably while commenting that having records available to patients and providers electronically were very valuable. In a May 2001 survey, Fowles and colleagues conducted a study which randomly sampled 4,500 adults who had a recent clinic visit and asked them if they had any interest in viewing their medical records.¹¹ Of the 81% who responded to the survey, 36% were very interested in viewing their medical record. The primary reasons for their interest included being very concerned about errors in their care, lacking trust in their physician, viewing what their physician said about them, increasing their involvement in their health care, and understanding their condition better.

Communication technology is a fertile ground for applying theories and models of prompt communication and health behaviors to guide the development of educational and behavioral interventions.¹² The diffusion of technologies is used by a variety of mechanisms ranging from the use of subsidies to the use of networks to encourage innovation but the electronic health information technologies represent tools in the diffusion process.^{13,14} Healthcare provider networks and regions across the United States have started using health information systems; one example is a multi-state provider network in the Midwest called PeaceHealth. Peacehealth connects to the community and providers through information system called Community Health Records (CHR).¹⁵ The CHR is a comprehensive and longitudinal patient care model that links to the various practice sites together.

Diffusion of Innovation

The process of diffusion of innovation is communicated through certain channels over time among the members of a social system. An innovation is the new idea perceived by individuals over a period of time. The most recognized theory in the realm of information technology is the Diffusion of Innovation theory by Everett Rogers.¹⁶ The Diffusion of Innovation theory is as to how, why, and at what rate new ideas and technology spread through society. This theory describes the spread of innovation through a population and how it is adopted by various cultures. It also conceptualizes the interpersonal and social process of the spread and adoption of health behaviors.¹⁷ There are four principles within the diffusion theory which fit well in to health information system innovation and diffusion. The first principle describes that anything new happening in personal health technology can be conceptualized to a change in health behavior for a population. The second principle explains the interpersonal influence upon the rate of adoption when an innovation in a population reaches a maximum. In the third principle, the stages of adoption are knowledge, persuasion decision, implementation and confirmation. The fourth and last principle is the interpersonal influence and how it mostly affects the later stages of adoption. Diffusion is referred to as the speed and spread of an innovation at the

population level, but it must spread among individuals too. Therefore the influence of diffusion at two levels incorporates interpersonal communication and brings about the change of health behaviors.¹⁸

Health information systems adoption connects patients to physicians, physicians and other clinicians to patient data and diagnostic testing centers, hospitals, and payers. Communication behavior changes with the use of these technologies. Changes may include quick decision making for patients, time saving measures for providers, reduced human errors, cost reductions, and a better working environment of health communication and behavior.¹⁹ Health information systems have revolutionized the way health information is gathered, disseminated, and used by healthcare providers, patients, citizens, and mass media, leading to the emergence of change in health behaviors and communication in populations.²⁰ Other theoretical models such as Behavioral Intention Theory, Social Cognitive Theory and PRECEDE – PROCEED Model share commonalities with the Diffusion of Innovation Theory.

Behavioral Intention Network

Three sections of the Behavioral Intention Network are similar with the Diffusion of Innovation Model. The Theory of Reasoned Action suggests that an individual's intention to adopt a technology is determined by reflecting personal interests and reflecting social influence.^{21,22} The Technology Acceptance Model (TAM) worked in occupational settings utilizing a wide spectrum of information technology solutions.³⁻²⁶ However, physicians, physician assistants, and nurse practitioners differ quite markedly from general users. They are highly educated, highly trained professionals, working in stressful and highly politicized environments. This model demonstrates that behavior is driven by the intention to use a system, which in turn is driven by the user's attitude and perceptions of subjective normative influences. Davis in 1989 noted how and why individuals choose to accept or reject technology. The similarity to the Diffusion Model is that perceived usefulness and ease of use can be seen as independent constructs without an explanation of their drivers.²⁷ The Theory of Planned Behavior describes individuals behaving in accordance with what they believe. This theory supports behaviors in medicine, education, business, and the general population. It indicates that doctors are ready to make changes from manual to digital, learn about the new technology, and obtain the necessary training in the use of the health information systems even though they are busy.²⁸

Social-Cognitive Theory

Social cognitive theory is based on the ideas that people learn by watching what others do and that human thought processes are central to understand personality. Self-efficacy is viewed as an important antecedent of information technology (IT) usage to the extent that it fosters both the adoption of new behavior and its maintenance.²⁹ In this theory, the ability of IT to support a task is expressed by the construct known as task-technology fit, which implies matching of the capabilities of the technology to the demands of the task. Task-technology fit posits that IT is more likely to be used if the functions available support (i.e., fit) the activities of the user. Users will choose those tools and methods that enable them to complete the task with the greatest net benefits.

PRECEDE – PROCEED-Model for IT

Kakafka et al in 2003 studied an adoption of Green and Kreuter's 1999 model of PRECEDE and PROCEED that is a conceptual framework used extensively for planning health promotion programs.^{30,31} PRECEDE (Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation) outlines a diagnostic planning process to assist in the development of targeted and focused public health programs. PROCEED (Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development) guides the implementation and evaluation of the programs designed using PRECEDE. The PRECEDE/PROCEED model directs towards outcomes rather than inputs and forces planners to begin the planning from the outcome point of view. Researchers omit two fundamental propositions: (1) IT usage is influenced by multiple factors and (2) interventions must be multi-dimensional.³⁰ The literature synthesis of their study provided additional insight into the reason for high failure rates associated with underutilized systems. This approach underscores the need to move beyond the current dominant approach that employs a single model to guide IT implementation plans. The plans aim to address factors associated with IT acceptance and subsequent positive use behavior.

DISCUSSION

Implications for Public Health Practice

Potential targets for change in the above described theories detail individual attitudes and beliefs, community cultural practices, and changes in organizational infrastructure. The change is brought about when the innovation represents a potential efficacy in solving a problem such as when individuals with curiosity and comfort with technological innovations experiment with a new innovational process. As per the diffusion of innovation theory, if any experiment in IT shows promise, individuals excitedly share the new approach with the social group of early adopters who attempt the new innovation. Once enough individuals join in utilizing an innovative process, the social group reaches a point where adoption of the innovation evolves rapidly.

When an innovation is compatible with existing values and needs of potential adopters, things move faster, cheaper and better, and requires little skill or training. It quickly diffuses and assimilates by key actors such as consumers, professionals, providers, and organizations. New information technologies have the potential to dramatically improve our health care system by ability to communicate and exchange data accurately, effectively, securely, and consistently.³² Health information systems help ensure that health-related information and services are available anytime and anywhere, permitting health care practitioners to access patient information and ultimately resulting in the development of more beneficial treatments to keep people healthy. There are advantages to implementing the theory at all levels of the socio-ecological framework (individual, community or organizational). EMR systems are currently being implemented slowly but the full benefits of interconnectivity are fully realized by the healthcare sector. The Roger's Diffusion of Innovation Curve indicates that the rate of adoption is 2.5% in innovators, 13.4% in early adopters, 34% in the early majority, 34% in the late majority, and 16% in laggards.¹⁶ Early adopters in our communities are the health professionals, physicians, lab technicians, and pharmacists who have proper education, training, and the availability of the systems to access. The early majorities are the leaders of the communities and have above average social status. The late majority are the adopters who are average persons in the community who will learn once other people have adopted the innovation. The laggards are the older citizens of the society who have little interest in learning the new technology.¹⁶ Delay in the process of diffusion include an inadequate understanding of the technological change effort, slow adoption, a lack of effective methods to implement the change, a lack of executive leadership or support, a lack of user training, high costs, standardization of processes, privacy issues, and lack of participation.

CONCLUSION

Health information technology is playing a significant role in improving the quality, safety, and value of health care. In recent years, the widespread adoption of electronic medical record (EMR) systems has improved health, reduced medical errors, and provided patient safety benefits. Effective EMR implementation and networking eventually saves more by improving health care efficiency and safety such as chronic disease prevention managed by health information systems could increase the savings while increasing health and other social benefits. The acceptance and availability of electronic medical records, electronic health records, and personal health records via clinical information systems are essential to high quality and safe medical care for the population anywhere and anytime. The Theory of Diffusion of Innovation using health information systems affects the healthcare and public health model of assessment, policy development, and assurance. While conducting health assessments, data are continuously being gathered electronically, analyzed, and interpreted. Health agencies or healthcare organizations use information from health assessments to develop and implement policies that reduce risks, especially on medical errors. Policy development activities include planning and priority setting, training in computers & information systems, and consistency building that encourage public and private sector to adopt new innovations in healthcare. The assurance component manages short and long term chronic disease preventive care, adverse medical or drug reactions, decision making and real-time reporting that becomes the essential part of the systems. Diffusion of innovation in healthcare, such as widespread use of health information systems at all levels and the sharing of electronic health records through hospital and community networks can eliminate human errors. The diffusion of health information technology will soon be regarded as an individual, a community, and a national standard of practice.

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