The Power of a Triangulation Study in Healthcare System Implementation

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Abstract
The US Government is mandating a transition from paper-based patient record systems to electronic medical record systems (EMR), as well as an adopting of the personal health record (PHR). This research seeks to employ non-clinical IT adoption models in a clinical setting to understand how the legal governances, incentives and penalties, and unremitting changes in requirements impact the adoption of EMR. The long-term implementation of a mature EMR will impact the continuity of care in both clinical and non-clinical settings and in addition the information can be tethered to the PHR.

Author Keywords
Electronic medical record; unified theory of acceptance and use of technology; activity theory

ACM Classification Keywords
Theory; H.1.m. Models and Principles: Miscellaneous.

Introduction
The electronic medical record (EMR) is defined as electronic records of "health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one healthcare organization" [2]. The personal health record (PHR) is a collection of health-related information, similar to that contained in the EMR that is documented and maintained by

the individual it pertains to. EMR and PHR are beneficial as they help improve patient safety, provide better education, improve both decision support and communication, and enhance health care services when needed independent of the clinical or non-clinical environment. The HITECH Act of 2009 compels healthcare professionals to both adopt and show "meaningful use" of EMRs by 2015 or they will suffer significantly from monetary penalties in the form of substantial reductions in Medicare and Medicaid reimbursements [7]. However, the regulations and requirements of EMRs are ever changing consequently causing subjective aversion on behalf of users.

The aim of this study is to examine how sociotechnical factors have impacted the adoption and use of EMRs and how its use affects the continuity of care. Self-care management in non-clinical settings is contingent upon the transparent connections between patient health information in the EMR and PHR. An accurate, reliable, and complete PHR promotes healthy living beyond the clinical environment; therefore it is necessary to investigate the factors of adoption and use.

The Unified Theory of Acceptance and Use of Technology (UTAUT) and Activity Theory (AT) are the theoretical constructs that will serve as a guiding framework for this research initiative. A triangulation study is needed because not all of the factors being explored fall under the UTAUT model. The impact of government mandates, the incentives and penalties, are factors that can be explained by the social influence construct of the UTAUT model. At the same time, however, the continuous changes in content and functionality requirements are factors that can be explained and understood more readily by AT; therefore, these two models were deemed most appropriate for this study.

The convergence of both models will illuminate the factors that contribute to the adoption and use of EMRs from an illness trajectory prospective to the use of the PHR from a self-management prospective which includes: (1) understanding an individual's behavior intentions, (2) understanding the social elements that impact the organizational environment, as well as (3) understanding the temporal elements of change that are imposed on the workflow and culture upon use.

Theoretical Frameworks

The UTAUT model is used to understand the adoption and use of information technology. Figure 1 illustrates the four constructs and the four intervening variables that impact a user's behavioral intention and use behavior. The facilitating conditions, a key construct in the model, are described as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" [8]. Perceived behavioral control is described as a person's ability to complete a given behavior, often referred to as self-confidence [4].

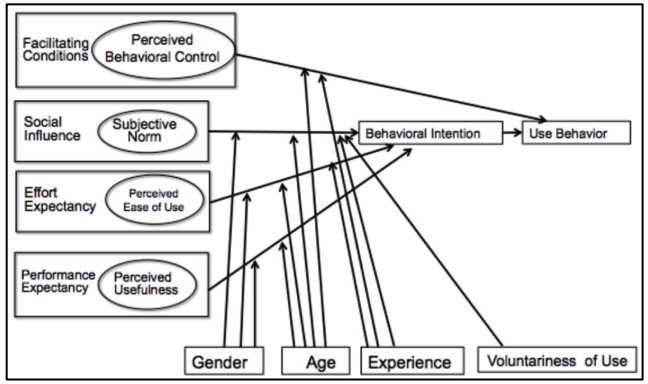

Figure 1. UTAUT Model [8]

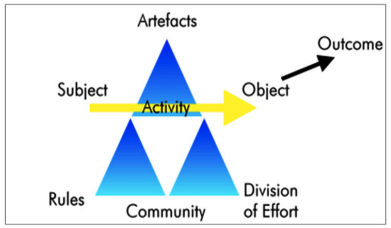

Figure 2. Activity Theory [3].

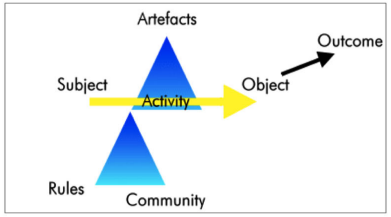

Figure 3. Modified AT.

The aforementioned indicator directly influences actual use behavior and they include facets of the organizational environment that are created to eliminate obstacles relevant to use.

Social influence is another construct in the model and it is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" [8]. The social influence construct is of primary interest because it is utilized to evaluate technology whose use is mandated, which is the case with the EMR. Effort expectancy is the degree to which an individual thinks that the amount of effort required to use the system is minimum [8]. Perceived usefulness in healthcare is further defined as making an individual's performance easier and more sufficient, enhancing efficiency and reducing costs, improving the quality of the service rendered to patients as well as improving patient safety [5]. Performance expectancy is defined as, "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" [8]. The intervening variables are gender, which impacts social influence, effort expectancy, and performance expectancy; age, which impacts all four key constructs; experience, which impacts facilitating conditions, social influence, and effort expectancy; and finally voluntariness of use, which impacts social influence [8]. As depicted in the Figure 1, performance expectancy, effort expectancy and social influence have been proven to impact the behavior intention of the user, while behavior intention directly influences the actual use or use behavior of the user.

The UTAUT model does not account for the element of change in workflow and work practices introduced to a sociotechnical environment when new artefacts and external mandates are employed. AT is therefore used to understand this element of change, which is critical because it can alter the nature of the culture, the way actions are accomplished, and ultimately the care continuum. This theory is decomposed into many interacting concepts (shown in Figure 2), but the proposed research will only focus on those concepts that are fundamental to technology studies (Figure 3) which are objects – goals held by the subject and motivates the activity; subjects – individuals, organization, or group doing the activity; artefacts- tools that mediate the subject and object; and rules-regulations governing the subject and artefacts [1].

The Proposed Model

Figure 4 depicts a preliminary vision of how the new combined model may appear. The model projects a lens, which the four facets of the illness to self-care management trajectory (physiological, temporal, sentimental, and social) can be further examined to improve the continuity of patient care across healthcare settings into daily living [6]. The envisioned EMR adoption model can potentially accelerate the adoption and use of EMR and connected PHR because stakeholders will have foresight about how to adequately address the key adoption determinants. Successful adoption will improve the continuity of care.

Conclusion

The goal of this study (and our workshop discussion) will center on the use of the AT and UTAUT frameworks to better understand and align with government mandates, incentives and penalties, and other changes in requirements that influence the adoption of EMR. The EMR is essentially information technology that has clinical and non-clinical implications. Successful EMR implementation

Key Constructs of the Proposed EMR Adoption Model

- The individual and the subject (used interchangeably) are governed by voluntariness of use, social influence, government mandates and most importantly rules.
- The subject or individual provider interacts with the artifact (in which case is the EMR) to accomplish the object of providing patient care and improving the care continuum.
- The rules dictate the course of action (e.g. activity) taken by the individual.
- The activities are dependent upon the temporal order of the patient's illness, which directly impacts the care provider's workflow [6].
- The performance expectancy, effort expectancy, and facilitating conditions directly influence the subject's use behavior of the EMR.

should enhance coordinated and integrated care between health care settings. Coordination of care will allow patients to have improved interaction with the care provider, thus impacting the sentimental facet of the illness trajectory. A mature EMR implementation should offer enhanced patient support whereby patients can easily access their health records. Access to these records will allow patients and their homecare providers the ability to provide adequate self-care in a non-clinical environment, thus permitting the patient to have better control of their physiological state.

Furthermore, this research does not fully explore the details of the ONC 2015 HITECH mandate, whether it seeks to determine how legal governances impact healthcare professionals and consumer options or how it alters the adoption and use of EMR and connected PHR. This study will inform the development of a new adoption framework for Health Information Technology across the continuum of health care into daily living.

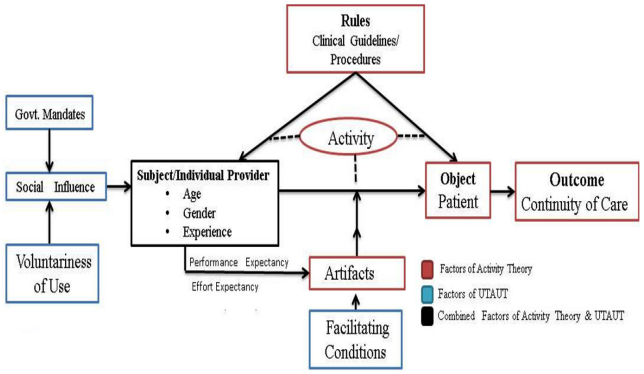

Figure 4. New Model for EMR Adoption

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