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A Business case for HIT Adoption: effects of "meaningful use" EHR financial incentives on clinic revenue

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Abstract

The goal of this study is to describe a framework that allows decision makers to efficiently evaluate factors that affect Electronic Health Record (EHR) adoption and test suitable interventions; specifically financial incentives. The United States healthcare delivery system is experiencing a transformation to improve population health. There is strong agreement that "meaningful use" of Health Information Technology (HIT) is a major enabler in this effort. However it's also understood that the high cost of implementing an EHR is an obstacle for adoption. To help understand these complexities we developed a simulation model designed to capture the dynamic nature of policy interventions that affect the adoption of EHR. We found that "Effective" use of HIT approaches break-even-point and larger clinic revenue many times faster that "average" or "poor" use of HIT. This study uses a systems perspective to the evaluate EHR adoption process through the "meaningful use" redesign as proposed in the American Reinvestment and Recovery Act 2009 in the United States healthcare industry by utilizing the System Dynamics methodology and Scenario Analysis.

Keywords:

Electronic health record, Health information technology, EHR, HIT, System dynamics, Care management plus, Meaningful use, Adoption, Diffusion, Financial incentives, Revenue, Scenario analysis, Physicians, Care managers, Policy, National healthcare

Introduction

In order to introduce significant and measurable improvements in populations health in the United States, various government and private entities seek to transform the healthcare delivery system by enabling providers with real-time access to medical information and tools to help increase quality and safety of care [1]. Performance improvement priorities have focused on patient engagement, reduction of racial disparities, improved safety, increased efficiency, coordination of care, and improved population health [1]. Using these priorities the Health Information Technology (HIT) Policy Committee, a Federal Advisory Committee (FACA) to the U.S. Department of Health and Human Services (HHS), has initiated the "meaningful use" agenda for adoption of Electronic Health Records (EHR).

Fueled by the $19 billion investment available through the American Recovery and Reinvestment Act of 2009 (Recovery Act), efforts are in full swing to accelerate the national adoption and implementation of health information technology (HIT) [2]. The Recovery act authorizes the Centers for Medicare & Medicaid Services (CMS) to provide payments to eligible physicians and hospitals who succeed in becoming "meaningful users" of an electronic health record (EHR). Incentive payments begin in 2011 and phase out; by 2015, non-adopting providers will be subject to financial penalties under Medicare [1].

Medicare is a social insurance program administered by the United States government providing health insurance to people aged 65 and over, or individuals with disabilities. Similarly Medicaid provides insurance for low income families [3].

CMS will work closely with the Office of the National Coordinator and other parts of HHS to continue defining incentive programs for meaningful use. The Healthcare Information and Management Systems Society (HIMSS) recommend that a mature definition for "meaningful use of certified EHR technology" includes at least four attributes [4]:

1. A functional EHR certified by the Certification Commission for Healthcare Information Technology (CCHIT);

2. Electronic exchange of standardized patient data with clinical and administrative stakeholders using the Healthcare Information Technology Standards Panel's (HITSP) interoperability specifications and Integrating the Healthcare Enterprise's (IHE) frameworks;

3. Clinical decision support providing clinicians with clinical knowledge and intelligently-filtered patient information to enhance patient care; and

4. Capabilities to support process and care measurement that drive improvements in patient safety, quality outcomes and cost reductions.

While existence of such mentioned programs is a motivation to consider using an EHR, historically adoption has been slow and troublesome [5]. One often cited obstacle is the high cost of implementing Electronic Health Records. Since usually incentives for adoption often go to the insurer recouping the

cost are difficult for providers [6-8]. Other challenges existing in the United States healthcare system include variations in practices and proportion of income realized from adoption [9,10].

Hence in this paper we propose that having a complimentary and value-adding care model next to the EHR will facilitate more meaningful use of HIT. One such product is the Care Management Plus (CMP) program developed at Oregon Health & Science University (OHSU)[11]. CMP is a validated and disseminated model of care coordination, information technology, and quality improvement in primary care for older adults and patients with complex, chronic diseases [12].

CMP couples an ambulatory care team with health information technology (HIT). For seniors with complex needs, CMP demonstrated a 20% reduction in mortality, a 24% reduction in hospitalizations and a 15-25% reduction in complications from diabetes [13, 14]. CMP facilitates use of HIT to establish and track care plans and specific patient goals, to teach and encourage self-management, to measure and improve quality, and to manage the complex and interleaving tasks as patients and teams prioritize needs.

Background

The Care Management Plus (CMP) model for primary care, developed by researchers at Intermountain Healthcare through funding from the John A. Hartford Foundation, uses specially trained care managers and tracking software to help clinics better care for patients with complex chronic illness. The model helps the clinical team prioritize health care needs and prevent complications through structured protocols, and it provides tools to assist patients and caregivers to self-manage chronic diseases. Specialized information technology includes the care manager tracking database patient summary sheet and messaging systems to help clinician's access care plans, receive reminders about best practices, and facilitate communication between the health care team.

CMP focuses on two primary areas: well-trained care managers embedded in the clinic and IT technology to help them manage patients with chronic illnesses. Figure 1, describes the primary aspects of the CMP program. Physicians refer patients with complex needs (about 3-5% of the population in primary care clinics) into the program. The care manager then co-creates a care plan with the patient, acts as a guide to help the patient and family meet their goals, and facilitates access to necessary resources when the patient or family needs navigation [15].

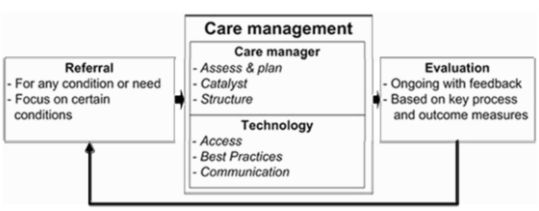

Figure 1- Care Management Plus

Figure2 shows a systems view of the Care Management Plus Program and its interaction with the EHR and various stakeholders. Integrated Care Coordination Information Systems (ICCIS) is the new revision of the Information Technology component of the CMP model. Physicians, Nurse Care Mangers, Patient and Patient family are able to interact and manage the patient's continuous care through the ICCIS web-0based interface. Additionally the ICCIS database is integrated with the EHR database for two way communication and reduced redundancy.

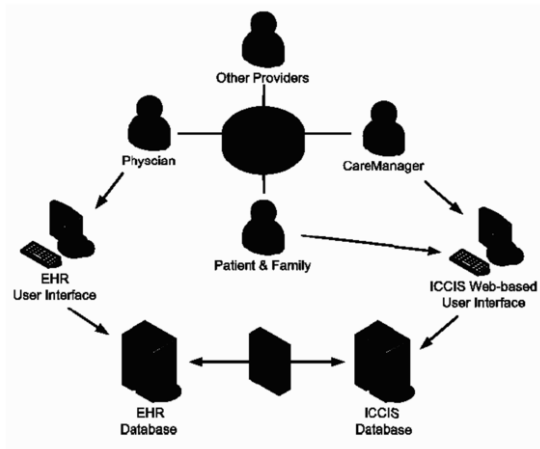

Figure 2- Medinfo 2010 paper submissions

Methodology

The goal of this study is to evaluate a framework that allows decision makers to efficiently evaluate factors that affect EHR adoption and test suitable interventions.

To this end we have develop a comprehensive simulation model designed to capture the dynamic nature of policy interventions that affect the adoption of EHR. We have aimed to capture interactions in the adoption of EHR for hospitals, physicians and Nurse Care Managers.

We have developed scenarios for clinic types based on the representative demographic that have already adopted the Care Management Plus Program which are listed in the results section. Then we have built a model of the adoption process and life cycle using the System Dynamics methodology. System Dynamics was introduced by Jay W. Forrester in the early 1960s to study complex systems such as the urban dynamics problem is used to build our simulation model [16].

To perform the simulation we have ran the System Dynamics model for each of the scenarios and the results are discussed in the next sections.

The model captures the dynamic characteristics of policy interventions and can be used to test different policies that might influence the adoption of EHR while providing insights.

For our model, we chose the following policy interventions, which can affect adoption First, *physician productivity*, which

includes for example activities that would stream line the physician workflow. Second, *financial incentives*, such as government reimbursement for use of HIT. And third, *cost*, for example the resources necessary to implement an EHR. Figure 3 shows a high-level view of the system dynamics based simulation model.

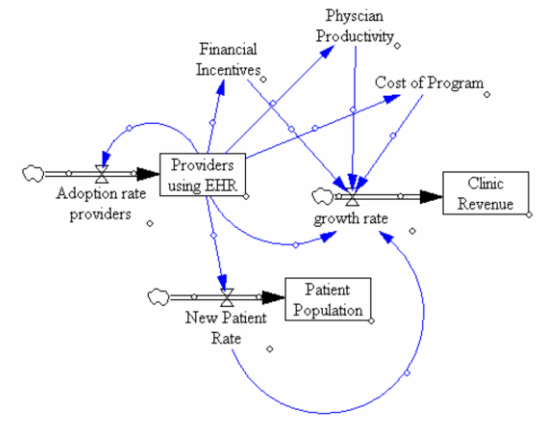

Figure 3- System Boundary

As stated previously it's this experiments goal to evaluate how policy interventions effect the adoption of EHR with meaningful use criteria while using the Care Management Plus program. To assess adoption of EHR, we propose the following set of dynamic conditions:

- *The more a Physician or a Nurse Care Manager is aware of EHR benefits, the higher the likelihood of adoption.*
- *The level and quality of "meaningful use" implemented by the clinic; low, medium or high will affect likelihood of successful adoption.*
- *Presence of Financial incentives will positively influence the adoption rate of EHR in hospitals and physicians offices.*

These hypotheses were examined using the system dynamics model created.

Results

In order to run the simulation three scenarios that were representative of existing CMP adopter clinic types were created and are shown in Table-1[15]. Small and medium sized private practices and a Safety Net Clinic are most common fit profiles of typical CMP users. Statistics of interest in the model included Number of physicians, number of Nurse Care managers in the practice as well as their patient panel size. The last column in Table1 lists the source of financial incentives for each clinic type, these numbers are average numbers based on available data [15]. Government incentive refers to Medicare and Medicaid reimbursements through the various programs available across the United States. Private incentive sources are mainly commercial sources and may include private insurance, employer-based funds or self-funding.

Amongst the listed scenarios a Small Rural Private Practice receives 53% of its total incentives from the government. Of that amount 50% is from Medicaid and 50% from Medicare. A Medium Private Practice in our second scenario receives 20% of it incentive from the government which 100% comes from Medicare. The Safety Net Clinic in our scenario receives 80% of its incentives from the government, with 75% from Medicaid and 25% Medicare. Health care safety net clinics are community-based providers who offer health services to low-income people, including those without insurance [17].

Table 1 - Clinic Type Scenarios

Clinic Type	**# of Physicians** **# of CareManagers** **# of Patients**	**Incentives**
Small Rural Private Practice	2 1 4600	Government: 53% Private: 47%
Medium Private Practice	5 1 11,500	Government: 20% Private: 80%
Safety Net Clinic	5 1 11,500	Government: 80% Private: 20%

In order to exercise the model we define three levels of HIT use with CMP:

- *Effective:* 40 patient referrals/month to CMP– meets meaningful use measures
- *Average:* 20 patient referrals/month to CMP– meets meaningful use measures
- *Poor:* 20 patient referrals/month to CMP– does not meet meaningful use measures

We run the simulation for each clinic for 3 years and the results are shown in Table 2. The new clinic revenue due to implementing CMP with EHR is listed in the second column of this table. New revenue is roughly calculated based on the formula below:

Revenue = (Patient Population Growth + Physician Productivity) - Implementation & Cost

The third column of the table shows the societal cost saving for each scenario. Average societal cost savings is estimated at $10,548 per hospitalization [12]. Societal savings were based on $640-$1,650 per patient per year savings.

Table 2 - Scenario Results after 3 years

Clinic Type	New Clinic Revenue	Societal Savings ($)
Small Rural Private Practice	-$76,776	$163,200 – $420,750
Medium Private Practice	$267,004	$409,600 – $1,056,000
Safety Net Clinic	$178,712	$409,600 – $1,056,000

Discussion

Figure 4 trends the clinic revenue due to implementing CMP with an EHR over roughly three years. The trends show that an initial investment in HIT affects the revenue of clinic adversely, which is expected. The three scenarios trended are with effective HIT use, Average and low as described in earlier sections. Effective use of HIT approaches breakeven point for adoption in 1 year. Average HIT with meaningful use break even at two years and poor usage of HIT almost breaks even in three years.

Therefore suggesting that better use of IT means the clinic recoups the cost earlier. However another interesting point is that effective and average use of HIT will lead to almost 5 times the revenue in three years compared to poor IT use. This is probably due to internal dynamics of the clinic workflow.

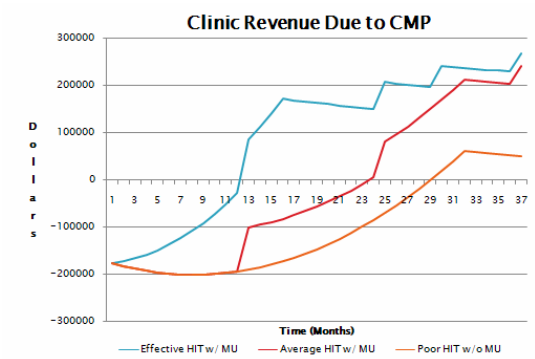

Figure 4 - Clinic Revenue Trend

Figure 5 takes a closer look at the complex system and reveals a positive feedback loop in the system. The more people are referred to Care Management, the more CM patient encounters and therefore larger financial incentives from government and private sources. There will be more revenue for the program which can lead to increased total clinic profit, which requires hiring new care mangers to handle the load. This positive feedback should generate financial incentives that continue to entice the providers to use HIT in a meaningful way.

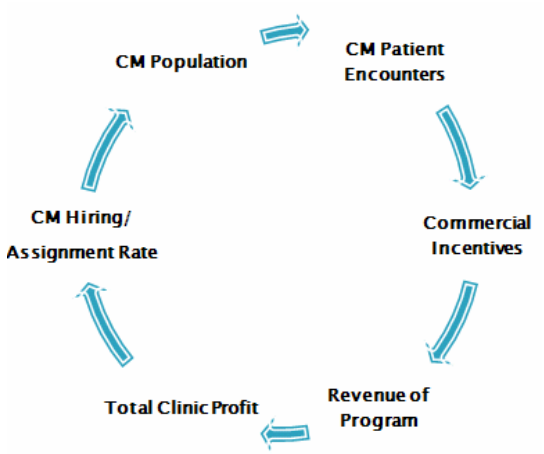

Figure 5- Incentive Positive Feedback Loop

Conclusion

This study uses a systems perspective to the evaluate EHR adoption process through "meaningful use" redesign in the United States healthcare industry by utilizing the System Dynamics methodology with Scenario Analysis. The model provides insights to understanding the factors influencing the adoption process and their interactions.

In this study, we investigated the often troublesome process of EHR adoption among hospitals, physicians, and patients. This study highlights the need for financial incentives with effective HIT meaningful usage for promoting EHR adoption.

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More information regarding CMP is available through the Care Management Plus website at:

http://www.caremanagementplus.org

References

[1] U.S. Department of Health & Human Services, "HealthIT.hhs.gov: Health IT Policy Committee."

[2] Assistant Secretary for Public Affairs, "Process Begins to Define "Meaningful Use" of Electronic Health Records."

[3] U.S. Department of Health & Human Services, "Centers for Medicare & Medicaid Services."

[4] M. Merrill, “HIMSS publishes 'meaningful use' definitions,” Healthcare IT News, Apr. 2009.

[5] J. Ash and L. Goslin, “Factors affecting information technology transfer and innovation diffusion in health care,” Innovation in Technology Management - The Key to Global Leadership. PICMET '97: Portland International Conference on Management and Technology, 1997, pp. 751-754.

[6] B. MIDDLETON, W.E. HAMMOND, P.F. BRENNAN, and G.F. COOPER, “Accelerating US EHR Adoption: How to Get There From Here. Recommendations Based on the 2004 ACMI Retreat,” Journal of the American Medical Informatics Association, vol. 12, 2005.

[7] B. Cherry, “Determining facilitators and barriers to adoption of electronic health records in long-term care facilities.,” UMI Dissertation Services, ProQuest Information and Learning, Ann Arbor, MI, 2006.

[8] N. Menachemi, “Barriers to ambulatory EHR: who are'-imminent adopters' and how do they differ from other physicians?,” Informatics in Primary Care, vol. 14, 2006, pp. 101–108.

[9] T.U. Daim, R.T. Tarman, and N. Basoglu, “Exploring Barriers to Innovation Diffusion in Health Care Service Organizations: An Issue for Effective Integration of Service Architecture and Information Technologies,” Hawaii International Conference on System Sciences, Los Alamitos, CA, USA: IEEE Computer Society, 2008, p. 100.

[10] C. Angst, “Information technology and its transformational effect on the health care industry.,” Dissertation Abstracts International Section A: Humanities and Social Sciences, 2007.

[11] N.A. Behkami and D.A. Dorr, “User centered design in complex healthcare workflows: the case of care coordination and care management redesign,” 2009.

[12] D.A. Dorr, A.B. Wilcox, C.P. Brunker, R.E. Burdon, and S.M. Donnelly, “The effect of technology-supported, multidisease care management on the mortality and hospitalization of seniors,” Journal of the American Geriatrics Society, vol. 56, Dec. 2008, pp. 2195-2202.

[13] D.A. Dorr, A. Wilcox, L. Burns, C.P. Brunker, S.P. Narus, and P.D. Clayton, “Implementing a Multidisease Chronic Care Model in Primary Care Using People and Technology,” Disease Management, vol. 9, 2006, pp. 1-15.

[14] D.A. Dorr, A. Wilcox, S.M. Donnelly, L. Burns, and P.D. Clayton, “Impact of Generalist Care Managers on Patients with Diabetes,” Health Services Research, vol. 40, 2005, pp. 1400-1421.

[15] “Care Management Plus -- Oregon Health & Science University.”

[16] G.B. Hirsch, “System Dynamics modeling in health care,” SIGSIM Simul. Dig., vol. 10, 1979, pp. 38-42.

[17] “Health Care Safety Net Clinics.”

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