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Implications of Modified Waterfall Model to the Roles and Education of Health IT Professionals

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***Abstract*—Electronic Health Records (EHRs) are believed to have the potential to enhance efficiency and provide better health care. However, the benefits could be easily compromised if EHRs are not used appropriately. This paper applies a modified waterfall life cycle model to evaluate the roles of health IT professionals in the adoption and management of EHRs. We then present our development of a Masters' program in Medical Informatics for the education of health IT professionals. We conclude that health IT professionals serve key roles in addressing the problems and concerns and help fulfill envision of EHRs.**

I. INTRODUCTION

Electronic Health Records (EHRs) are believed to have the potential to enhance efficiency and provide better health care. In reality, studies have showed challenges and concerns in the adoption of EHRs. A report [5] from IOM (Institute of Medicine) stated that many problems arise due to the mismatches between the work-as-designed and work-in-practice.

Traditionally, EHRs are designed and developed going through several key stages in a waterfall model or risk driven spiral model [2]. At first, requirements of EHRs are collected from health care professionals. Followed are the stages for specifications of the EHRs, designs of the software, prototype development, testing, implementation, and maintenance. In a spiral model, the stages between requirement collection and the prototype development could be cycled for a few times. The final product through this process assumes that formal procedures are followed in the work environment. Unfortunately, the complexity of health care sector always presents unexpected scenarios and unintended consequences of the adoption of health IT products [3].

Hembroff *et. al.* [4] stated that wrong person's records could be used in cases of incorrect identification of patients. This could happen because of the algorithms used in the software along with inappropriate operations over the human-computer interface. Such issues are hard to be fully recognized at design time. Another scenario of unexpected usage of the EHR system was reported in [1]. For the convenience of daily use, the clinical staff uses the same user name and password. Also, the interface screen could be unattended at times. This work-in-practice, or work-around, inevitably compromises the initial designs for the protection of patient privacy and access accountability. In a security enforced system, a group of people could be granted the same privileges, but individuals still need to have their own user account and password so that their activities will be accounted for. The forced screen protection could also be enabled for the protection during absence of staff. Unfortunately, these design features could be easily overridden by management of work force after implementation.

In the adoption and management of EHRs, health IT professionals are important components to ensure appropriate formal procedures and enhance user experience. This paper applies a modified waterfall life cycle model to evaluate the roles of health IT professionals. We then present our development of a Masters' program in Medical Informatics for the education of health IT professionals. We conclude that health IT professionals serve key roles in addressing the problems and concerns and help fulfill envision of EHRs.

II. MODIFIED WATERFALL MODEL

We use the modified waterfall model to depict an EHR's life cycle (Fig. 1). In this model, extra arrowed lines are added below maintenance stage to link back to the above stages. This explicitly specifies that after an EHR is deployed, it will not be a final product. Future upgrades are expected based on the feedback from maintenance stage. This modified waterfall model bears significance in understanding the process in adopting EHRs. It also implies a key role the health IT professionals play in ensuring the appropriate EHR functions and helping with a better version of future EHRs.

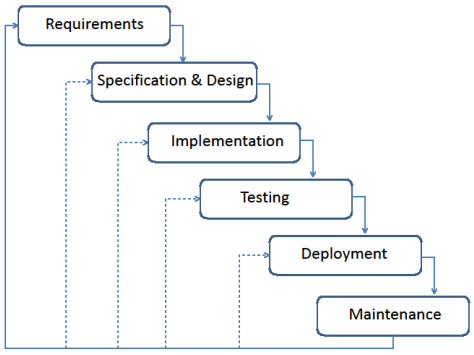

Fig. 1. Modified waterfall life cycle model for EHRs

III. IMPLICATIONS OF THE MODIFIED WATERFALL MODEL TO HEALTH IT PROFESSIONAL ROLES

The modified waterfall model could imply that the original designs can be outdated quickly because new medical

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technologies and new medical procedures might not exist at design time. Second, the users need to have adequate training to understand all the features and functions as designed. Third, the general specifications could force workflows to change in various settings, or otherwise there must be work-around. Without mechanisms to address these issues, the adoption of EHRs cannot assure health care efficiency or patient safety. Any such mechanism will get the involvement of health IT professionals.

Ideally, if the software development team belongs to the health care organization, and the health IT professionals (maintenance) are in place at the first hand, they could work together to implement the most pertinent EHR to the organization. The health IT professionals can get involved in every stage during the initial designs. In this case, any feedback will be processed in a timely manner. This scenario is not practical for middle sized and small sized health care organizations. For them, they have to adopt third party software. A third party EHR is considered the final product from the software developer's point of view. Looking at the modified waterfall model, it is clearly not the case. New request for modifications based on user feedback could happen anytime. There must be service agreement stating the feedback communication channels and the timeliness to address any feedbacks. Fig. 1 shows that the maintenance serves as a hub to connect users and software providers. Generally, the main roles of health IT professionals include:

- Evaluate the various third party EHRs and select the most pertinent to the organization;
- Get trained and deploy the selected EHR;
- Train the users, including doctors, nurses, and other health care professionals;
- Get the users prepared for EHR system outages;
- Maintain the system functioning as designed, and enforce security and privacy applications;
- Gather and analyze user feedback and request modifications from the software providers;
- Upgrade the system.

IV. Opportunities For Health IT Professionals

The role requirements impose challenges to health IT professionals. Especially seeing from the waterfall model, the maintenance must serve as a bridge between the clinical users and the software developers. To fulfill this task, the health IT professionals must have skills in networks, computer systems, database management, even programming. Most importantly, they must also be familiar with health care workflows; they must understand EHR standards and regulations. Lack of capable health IT professionals will cause not only the adoption of EHRS is hindered, but also the patients safety is threatened.

Studies showed that the adoption rate of EHRs by U.S. hospitals had been slow [6,7]. The main reasons were due to the health care providers' unfamiliarity with computer technology [7]. However, the importance and potential benefits of EHRs are recognized by all sectors. The Congressional Budget Office is inputting approximately $30 billion for Medicare and Medicaid incentives to stimulate wide adoption of EHRs [8]. ONC (Office for National Coordinator) for Health Information Technology has funded millions of dollars to initiate programs to train health IT professionals [9]. It is foreseeable that EHRs will be in a quicker pace to be adopted and capable health IT professionals will be a new demand by market.

To meet the challenges and embrace the opportunities, we have developed a Masters' program in Medical Informatics based on the undergraduate program of Computer Network and System Administration. We recruited faculty members in variety of expertise, such as in network engineering, system administration, database management, and clinical practice. The undergraduate studies focus on network and systems. The graduate studies focus specifically on health care systems. We expect such a combination of programs to be a valuable campground to output capable health IT professionals.

V. Conclusion

EHRs are believed to have potentials to enhance efficiency and improve patient safety. However, the benefits could be easily compromised if EHRs are not used appropriately. The waterfall life cycle model reveals the key roles of health IT professionals in the adoption and application of EHRs. These roles further present special educational requirements for individuals and for IT education providers. We conclude that only after the health IT professionals are appropriately trained, and only after the roles of health IT professionals are fully enforced, will any envision of EHRs be truly fulfilled.

References

[1] Baker A, Vega L, DeHart T, Harrison S. Medical Record Privacy: Is it a Facade? Proceedings of Conference on Human Factors in Computing Systems. 2011

[2] Hamlet D, Maybee J. The Engineering of Software. Pearson Education. 2001

[3] Harrison MI, Koppel R, Bar-Lev S. Unintended consequences of information technologies in health care: an interactive sociotechnical analysis. J Am Med Inform Assoc. 2007; 14(5):542-549

[4] Hembroff GC, Wang X, Muftic S. Providing an additional factor for patient identification based on digital fingerprint. Proceedings of the 2nd USENIX conference on Health security and privacy. 2011

[5] IOM (Institute of Medicine). 2011. Health IT and Patient Safety: Building Safter Systems for Better Care. The national Academies Press.

[6] Jha AK, DesRoches CM, Kralovec PD, and Joshi MS. A Progress Report On Electronic Health Records In U.S. Hospitals. Health Affair October 2010 29:101951-1957

[7] Meinert DB, Peterson D. Perceived importance of EMR functions and physician characteristics. Journal of Systems and Information Technology, 2009 11(1), 57-70

[8] Letter to the Honorable Charles B. Rangel, Chairman, Committee on Ways and Means, U.S. House of Representatives. http://www.cbo.gov/ftpdocs/104xx/doc10430/House_Tri-Committee-Rangel.pdf. Accessed January 12, 2012.

[9] The Office of National Coordinator for Health Information Technology. http://healthit.hhs.gov. Accessed January 12, 2012.