

Improving Usability of EHR Software through Design for Progressive Enhancement

With a Case Study of Anfani Open Source EHR Software

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Abstract: EHR software are the way of the future for healthcare delivery. They can help recognize and contain epidemics, cut healthcare administration costs and enable doctors to search records more rapidly or share patient data with remotely located specialists. However, the typical EHR package is seen as an intrusive addition to the workflow of many established healthcare establishments, primarily because they are usability deficient. This paper takes an alternative look at the design of EHR software from the perspective of usability and with a focus on progressive enhancement in terms of available functionality. An insight to how this model works is shown as a case study of the open source Anfani EHR.

1 INTRODUCTION

Statistics on the use of EHR systems in developed countries are quite impressive and attest to the recognition of the catalyzing role that such technology play in the global improvement of workflow in healthcare establishments.

Nevertheless, there still remains resistance to adoption, from many health professionals primarily for reasons relating to following:

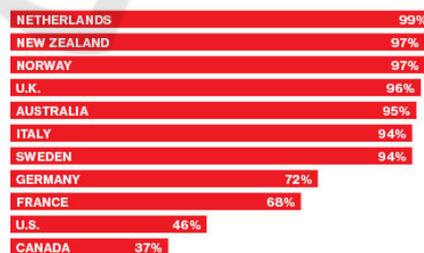
Start Up Cost - The typical cost of switching to electronic medical records may often be enormous. These will include for the purchase of equipment to record and store patient data, as well as for converting all existing data to electronic form.

Training Cost - Further, staff have to be trained, and while being trained they must be paid for non-productive time.

2 DESIGNING THE PERFECT EHR

Basically an EHR should be able to provide easy to read clinical summaries of all active patient problems, visits, medications, and lab results. But many EHR salesmen believe in the “perfect” EHR, which must contain all possible features including records, laboratory, medication, radiology, health

Practices with electronic medical records*



*AS OF 2009 DATA: COMMONWEALTH FUND

Figure 1: EHR comparative usage.

information exchange, and automated export to databanks.

3 USABILITY AND DESIGN OF EHR SOFTWARE

Usability traditionally describes the interactive experience associated with the user interface, of the software application. Usability determines how easy it would be to use the software, whether the software will be engaging and satisfying to use, and whether it will effectively support users’ goals ,tasks and expectations.

While striving to create a “more perfect” EHR

than the competitor, many vendors eventually create “bloatware”, containing a multitude of features, and technological capabilities which seek to amaze, and probably do very little else. Many contain superfluous features that do not support the goals and tasks of the typical user, but which they must nevertheless pay for and spend money to learn. Above all they require users to adapt their attitudes and behavior in order to get synchronized with the new system. Thereby, rather than support its intended users’ existing beliefs, attitudes, and behaviors as they relate to the tasks that the system is being designed to support very many HER software tend to be distractive..

3.1 Defining Usability

The typical parameters which may be used to define software usability and especially as it concerns EMR/EHR are explained in the document, *Defining and Testing EMR Usability: Principles and Proposed Methods of EMR Usability Evaluation and Rating*; which was created by HIMSS EHR Usability Task Force. These parameters include:

- *Simplicity* - which is defined as lack of visual clutter and concise information as well as inclusion of only functionality that is needed to effectively accomplish tasks.
- *Naturalness* - refers to how automatically “familiar” and easy to use the application feels to the user.
- *Consistency* - how does the application’s structure, interactions and behaviors match a user’s experience with other software applications. ?
- *Minimizing Cognitive Load* - which could negatively impact patient safety as a result of an extra addition to the multiple demands for the attention of the typical clinician
- *Efficient Interactions* - by minimizing the number of steps it takes to complete tasks.
- *Effective Information Presentation* - in a user friendly and not overtly technical manner.

Usability and Ease of Learning

Software usability reveals in improved ease of learning or learnability. The use of consistence concepts, behaviors, layout, and such features all effectively lower the learning curve of software. The ease of learning can be evaluated in terms of the time it takes the user to reach a specified level of proficiency and in terms of the time it takes a user who has never seen the system interface to successfully accomplish basic tasks. Consistence is

here also described as a similarity with previous data storage and retrieval methods and workflows

4 DESIGNING EHR FOR PROGRESSIVE ENHANCEMENT

Most EHR design typically tend to be focused on functionality. A user-centered design (UCD) on the other hand engages a design process from the perspective of how the software will be understood and used by a human user. The result of employing UCD to EHR design is a product that offers a more efficient, satisfying, and user-friendly experience for the user. Our model of the perfect EHR lacks usability because it contains too many bundled features employ a system that initially makes the bare essentials available in an easy-to-use form and then enables optional addition of more functionality if the need arises. This design philosophy of “progressive enhancement” is a current best-practice trend in creating multi-user software, and which originally relates to web technologies. It basically describes the art of "separating document structure and contents from presentation, and behavior. This principle could also find use in the development of software intended for use by several classes of professionals each with a different need. The principle, applied to the design of EHR will suggest that:

- Basic functionalities (patients’ record form) should be accessible to all users
- Enhanced behavior (e.g. prescription, accounting, charts) should be provided by add-on modules.

5 CASE STUDY: ÀNFÀNÍ EHR

Ànfàní EHR was from the onset designed with the major tenets of usability in mind. Simplicity and naturalness were highly desired features. It was initially created as a research tool for consultants at the University of Ibadan Teaching Hospital (Nigeria) and later released as free and open source software. The initial objective of the Ànfàní EHR project was to make free and easy-to-use EHR software available to health establishments in developing countries Ànfàní is a Yoruba word which means “*beneficence*”.

5.1 Architecture

The basic backbone of the Anfani-EHR system is a Drupal framework. Drupal is a PHP development software which has over the years shown superior capabilities in the creation of web-based application. Anfani-EHR as well as other related add-on modules sits on top of this Drupal stack as a distribution of the original framework.



Figure 2: The Anfani-EHR architecture.

5.2 Platform

The Anfani EHR was developed with PHP/AJAX and to run on a Linux server environment. Nevertheless, many users have successfully run it on a Windows PC by using emulation software such as WAMP or XAMPP to simulate the Linux server environment. The software may also be successfully run from a flash drive. Additionally, because the biggest promise of the Drupal base is its versatility as a web programming framework, Anfani-EHR naturally lends itself to cloud hosting

5.3 Features and Functionality

Anfani-EHR is a database application consisting of patient record forms piggybacked on the Drupal framework. In summary Anfani EHR offers following basic features

- Editable electronic patients records forms
- File and image uploads (documents, image, audio, video)
- Internationalization - Interface translation in English, French, Spanish, Portuguese, and Arabic.

This basic functionality may be progressively enhanced by adding more modules such as for accounting, drug prescription and several others as the need arises.

5.4 Usability Assessment

On the basis of the previously enumerated parameters for evaluation of usability, the following is a brief examination of how Anfani EHR measures up:

Simplicity - The basic demographic records, including of visits, condition, and associated media are entered and accessed from a single screen.

Naturalness - The record forms are intuitive and built in the way clinicians are already used to entering data on paper forms. With little technical knowledge the basic form can be edited to requirement of the health establishment.

Consistency - User interfaces are intuitive and include search functions with a natural feel.

Usability and Ease of Learning - Most users achieve 90% proficiency within 2 hours.



Figure 3: Typical patient record page.

5.5 Road Map

The focus ahead for Anfani EHR still remains to be able to achieve the functionalities of the “perfect” EHR, albeit in a different way- through a path of enabling progressive enhancement. The preferred method is to make more functionalities available as add-on modules for specific users rather than as unwanted features bundled in together.

Connectivity - The connectivity issue naturally arises with EHR due to difference in database structure across different software. Presently it is possible to run isolated instances of Anfani-EHR on widely distributed computers and have their database records uploaded to populate a larger database. This would be an inexpensive way to build national health records databases especially in developing countries. Alternatively the entire system can be naturally cloud hosted for real-time records

management, though this will require avoidable infrastructure maintenance costs.

Prescription – One of the greatest challenges of the Anfani –EHR system remains the development of add-on modules relating to drug database for running the prescription functionality. This is for the reason that such data differ from one country to another. But naturally as this is an open source project, the code is freely modifiable for creating new drug database modules for users in a specific country.

6 CONCLUSIONS

This paper looked at the problems relating to the design and use of electronic records management software. It especially looks at how factors such as optimistic design for functionality and poor usability have become the bane for the use of EHR. It further looked at how this can be improved by the process of building functionality into EHR software through the technique of progressive enhancement. The case study for the propositions enumerated in the paper is the open source Anfani EHR, which demonstrates simplicity, scalability, and low integration costs as the main features of a highly usable EHR software.

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