

# **HIT Policy Committee**

## **Certification / Adoption Workgroup**

### **EHR Usability Testimony**

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Good afternoon. My name is Carl Dvorak. Thank you for inviting me to share our usability practices and thoughts on the role of government in the area of EHR usability.

My formal education is in Computer Science and I had the privilege to have been the lead developer at Epic on our electronic health record, EpicCare, when we first created it as a Windows-based EHR for direct and real-time use by clinicians.

Before answering your specific questions, I'd like to share a few practical insights into usability that might otherwise go unnoticed in today's meeting.

First, I have been programming since I was in high school and have developed software on a wide variety of systems going back to the almost forgotten TRS 80s, Commodore, CPM, original DOS and DG Eclipse computers and using an equally wide variety of user interface approaches from roll and scroll, cursor position-able terminals like the VT220/320, early graphical user interfaces such as Windows and now touch-controlled interfaces such as the Android and iOS platforms. I mention this today because it is important to remember that usability is often both enabled and constrained by the underlying technology and the consumer's ability to afford to purchase and cost effectively maintain that underlying technology. The existence of today's iPad is not an indictment of the Windows GUI, it is simply the next step in an evolution that began with punch cards and has progressed through the years.

Second, in my 24 year career at Epic I've had the opportunity to talk to many thousands of physicians and nurses in many settings including: domain learning and immersion visits, design sessions, implementation projects, floor support during EHR go lives and at optimization visits helping them tune their use of technology to their practice.

What I've learned is that there is one critical element of creating usable software that rises above all the design science and techniques I will share with you today and above all the testing and measurements that can be done on the software after it is created. That critical element is the immersion of the software developer into the domain for which he will be creating software. To understand what your user needs to accomplish is the single biggest factor in creating software that will be perceived as usable by providers.

Third, usability science seems to have the potential to help guide the masses to basic consistency and a minimum baseline experience for users. Yet, achieving that level does not automatically translate to usability in the eye of the clinician. Usability to the clinician is very simply allowing them to intuitively accomplish what they wish to accomplish, at the moment they need to accomplish it with the minimum

number of steps and computer lag time possible. What would make usability scientists happy won't always make clinicians happy.

Fourth, in preparation for today, I did a simple poll of EHR Association member companies on whether they had designated staff with defined roles in the design process and the testing process. And as well, whether they had defined processes for reviewing usability with their users (e.g., focus groups, structured feedback, etc.). I got responses from 19 member companies. The responses were interesting. 14 of the 19 had designated staff responsible for usability aspects of design. 13 of the 19 had designated staff responsible for usability in the testing process. 15 of the 19 had a structured user feedback process for usability. Of those that responded with a No, they do not have designated staff, what was interesting was that many of these vendors were small innovative vendors without single-purpose specialized staff in these roles and yet they had a strong focus on usability through their clinician users and focus groups. Their commentary indicated that usability was of course everyone's responsibility. The commentary from those that have designated usability staff indicated that a common function was often education, process and feedback rather than hands-on design. This matches my observation as well. Staff formally trained in usability may or may not actually be good designers themselves, but they often do help an organization stay current in their awareness of the existing usability science and techniques and can help manage a process to ensure they are applied at the right steps in the process.

### ***What is current industry practice in testing for usability?***

At Epic, we have specialized staff to assist with usability education, testing process and execution as well as user interface design experts to educate and participate in the creation of interfaces. We also hold routine educational sessions for our development and quality assurance staff in general on topics related to overall user experience.

Specifically for testing we use several methods to test and subsequently improve the usability of our software at different stages of its design and development.

- **Usability Testing** is a technique where designers observe users as they attempt to accomplish a specific realistic task in the system.
  - Tasks used in testing are created as a realistic scenario that users encounter in the course of their day.
  - During testing, users are instructed to verbalize their thought process as they execute the task.
  - Testing is meant to identify problems with the design, as well as spark discussion about more complex areas of the design that are revealed only through actually trying it.
  - Epic designs with immediate and direct clinician input, both from clinicians on staff and those of our customer organizations. Usability testing of a design typically starts with internal staff familiar with the users and use cases, in order to catch the larger problems. We do a second round of testing with clinicians, again internal and external, to identify additional problems.

- Results are compiled in a few ways:
  - Task completion rates (not completed, completed with difficulty, easily completed)
  - System Usability Scale (SUS) - subjective user survey taken after the test
  - A prioritized list of problems and opportunities identified, including pertinent user discussion and suggestions for improvement or further research required
- Challenges:
  - **The time necessary to do this level of testing** for every design is very significant and not always practical in order to meet constantly changing needs.
  - **Gaining access to ideal candidates for testing.** Usability test subjects should represent users as realistically as possible. Often, physicians are not willing to take time away from practice to participate unless they are compensated or feel particularly strongly about the software, which skews the results.
  - **Simulating work environment.** Usability testing is most effective when performed with an everyday user in their normal work environment. For example, an emergency department triage nurse at her station in an emergency room. Because of the safety implications, it is necessary to do this in a simulated environment.
- **Hallway Usability Testing** is a slimmed-down version of Usability Testing where selection of the tasks and the test subjects is not as rigorous. The biggest advantages are that preparation time for this is a fraction of the prep time for Usability Testing, and that major usability issues are discovered in a fraction of the time.
- **Expert Review** - When we complete a prototype of a design, a group of usability experts identify any violations of usability principles that can lead to user errors and frustrations; for example, consistency, error prevention, and recognition rather than recall. One method of doing this is through a formal heuristic evaluation.
  - The design is evaluated by simulating a user's workflow; each screen of the workflow is then examined for usability issues, which are categorized by what heuristics were violated and the severity of the issue
  - Each evaluator also provides alternative suggestions for eliminating the issue or minimizing its impact
  - Throughout the development process these issues are verified alongside the design requirements to iteratively improve the design
  - Heuristic evaluations are most effective during the design phase and are good at finding many usability problems without requiring actual users.

**Choosing which methods to apply to a given project is a challenge.** In order to efficiently respond to changing clinical, governmental, and business needs, the design and evaluation methods we use on a given design are proportional to the magnitude of the change, the relative risk of changes in that area, and its level of usage.

### ***What is current industry perspective for designing systems to ensure usability?***

**We start with understanding and verifying the core user need, its context, and why the need exists.**

We work directly with clinicians during design and development to ensure we fully understand the problem so that we can generate ideas for solving it and identify scenarios to evaluate the solution's effectiveness and efficiency.

**Designing for safety is a special class of usability.** In certain safety critical areas of our software, such as ordering, we have introduced a design process where during the initial design we will include an outside panel of clinicians from our user sites who have demonstrated competencies in evaluating designs as reviewers. This team is involved through the course of development and early reviews. After initial development is complete, we use a similar second panel that has not previously been exposed to the design to do an independent review for safety. We have observed that even if you are sensitive and skilled in design, once you become engaged with a particular design, you can develop blind spots to new problems that develop as that design evolves. A second independent panel of reviewers helps us identify another set of subtle problems that might have otherwise gone unnoticed until release. Designing for safety is often more about context sensitive workflow than just user interface mechanics and traditional methods are useful but still insufficient.

**Our solutions strive to make it easy to do the right thing.** It should be easy for users to get the information they need at the time they need it. It should be easy for users to complete required tasks. And not only should it be easy to do the safest thing for the patient - it should be difficult not to. This means reducing screen changes, scrolling, clicks, and cognitive load.

**We strive to use language natural to users.** Through user research and feedback, we work to ensure that screen elements reflect the user's operational language, rather than technical or regulatory language based on other concerns. Some of these wordings are configured by our customer organizations and others are under our control.

**We then validate that the need has been effectively met through testing** (see above), while maintaining all of the following:

- **The system must be responsive.** Performance is a key usability factor, and more than that, it is key to adoption and usage of the system. We obsessively minimize response times and respond immediately to unexpected performance situations in order to make sure clinicians have the immediate access to patient information that they need.
- **We strive to make the system consistent, with common sense.** Consistency throughout a system reduces cognitive load and the chance for user error. Consistency between systems has similar advantages. However, enforcing consistency blindly can often prevent exploration that would lead to significantly better alternatives. We must consider all possible solutions, and balance consistency with forward progress.
- **We strive to make the system learnable.** EHRs are professional tools that require some training, but at the same time, cannot be mastered in a classroom. Training should get users the critical knowledge they need to do their job. The system should then allow a user to gradually

discover features to further enhance their productivity and effectiveness as they become more comfortable.

**We guide healthcare organizations to make workflow decisions that create a good user experience.**

The user experience of healthcare software is strongly influenced by the workflow choices that need to be made as part of system implementation. It is key to help organizations understand the costs of a poor user experience to balance with the benefits of the configuration changes they make. And occasionally we've seen systems contorted to do things they were never designed to do in order to meet an unexpected regulatory or business change. We also see project teams occasionally prioritize standardization over meeting the needs of individuals or certain specialties that would benefit from different workflows or presentations of data that better meet their needs. Personalized order sets, preference lists and charting templates can often be the difference between a happy and successful clinician vs. one who feels the system is inconvenient.

## *Challenges*

- **Competing Goals**

- **User needs vs. safety, regulatory, business, and technical needs.** These are all interdependent concerns that must be thoughtfully considered and balanced for each complex problem that is solved.
    - A key example of this is incredibly long and tedious physician notes that cannot be easily or safely summarized by the system, spurred by current reimbursement and liability concerns and ambiguities.
    - Recent added reporting requirements for MU actually create new documentation points that are sometimes perceived to be usability problems with the computer system, or at least make creating a usable experience more challenging. e.g. Requiring human input to verify data that is already in the system: "why can't this thing be smarter and save me time?"
    - Make you click more to be safe. An extra click confirming and documenting that you have verified that an allergy list is unchanged from a previous visit.
  - **Efficiency vs. simplicity.** Showing too little information on a screen can lead to inefficient workflows or under-informed user decisions while showing too much can lead to cognitive overload where information, although visible, can be missed.
  - **Idealized medicine vs. reality of users.** A workflow designed by healthcare organizations might be optimal for organizational needs and meeting governmental requirements, but doesn't match how users think of their task or what they really have time to accomplish. (E.g., Too many sign-offs and notifications of certain information become a huge burden on users which can lead to the users just ignoring most of them.)
  - **Configurability vs. out-of-the-box design.** Healthcare organizations vary, sometimes widely, in their needs and practices, even within current and upcoming medical regulation, which creates a need for a system to be changed and optimized at each installation. This necessarily high level of configurability limits the extent to which vendors can independently control the user experience.
- **Measuring and comparing the efficacy of usability evaluation methods is a known challenge among design experts.** We know that these methods can identify usability issues but we can't

guarantee that they will find all existing issues with a design or that the results of these tests are numerically comparable between designs.

- **Cost of change to users and healthcare organizations.** Unlike consumer products, which can take risks with large user experience shifts and throw it into the market, enterprise software, and EHRs especially, must allow for optional and gradual transition from an old design to a new and improved design for users that are forced to change. Organizational-level work is often necessary to make it fit their needs effectively, which adds to the time necessary to get improvements to users. And no matter how intuitive the new design, training and communication can often be necessary to guide users through the change.
- **Usability tenets that apply in one area may not be transferrable to other areas.** Testing to see if one particular workflow is usable is relatively well contained. Testing to see if an entire system is usable is not only difficult, it may well be impossible.

### ***What voluntary steps can industry take to improve usability?***

- **Continue to work with physicians, nurses, and healthcare organizations to improve the tools that we provide,** and come up with creative new ways to make healthcare more effective and efficient. I would stress again that a deep understanding the domain is a key to great usability.
- **Define accountable owners for managing usability** awareness, education and engagement within your software development and testing groups as well as in your implementation groups.
- **Test for usability** at each stage of design and development.
- **Monitor user experience to improve usability** post-go-live, establishing reality-based baseline usability and success metrics and tracking progress in future updates. Work with industry analysts such as KLAS who measure user satisfaction.
- **Work with healthcare organizations to improve user experience through configuration and workflow design.** Add configuration guardrails and stronger guidance that optimize usability while still achieving organizational goals. Also develop style guides and other similar guides to steer the organizations towards user-friendly configuration of the system.

### ***What does the industry see as the government's role?***

I have many thoughts on this, and realize some of them may be in conflict with popular thinking on this topic.

We are all beginning to realize that our government resources are indeed finite and should be carefully managed and never wasted. A key question I struggle with is to what extent ONC/CMS resource expenditure in this area would produce a measurable improvement over the current course. And to what extent ONC initiatives might actually do more harm than good.

Fortunately, usability is not healthcare specific. It is universal. It is the elegance of everyday things. There are extraordinary efforts by many companies across all industries, including ours, to compete on usability and the ability to delight consumers. It is an exciting and vibrant time enabled by an entirely new generation of tools and infrastructure. I do not believe ONC or CMS needs to fund additional science or education in this area. The resources available to today's EHR developers are excellent and plentiful. ONC might, however, consider a library function to organize existing resources, but I don't believe that additional funding through ONC will significantly improve the current science in this area.

I also think it is wise for ONC/CMS to remember that most of the EHR companies competed on usability long before the stimulus program came along and will compete on usability of their product long after the stimulus program is gone. They are highly motivated to differentiate themselves from competitors and to delight users. That may not always be easy, and some may not always succeed, but it is an already existing and very powerful motivation – maybe the most powerful– survival demands it. I do not believe that ONC/CMS could do anything that would enhance this already powerful motivation.

There is a worry expressed by some that the stimulus program may have created the need for some form of consumer protection for physicians as they are being required to acquire and adopt an EHR for the first time. And, therefore, some measure should be taken to provide those physicians guidance as to the usability of EHR applications they might consider purchasing. If the government could do this in a careful and accurate manner, I would think that some simple mechanism could be useful in this short while as we move through the early part of the stimulus program.

Yet, as I meet with government leaders and begin to understand the approaches being considered in response to this perceived need I worry that a formal usability rating scale created in a rush by NIST or outsourced through a subcontractor would likely have more unintended negative consequences than leaving usability a decision managed by the purchaser. In order for ONC to provide a usability score, they would first need an idealized design of an EHR, then a grading rubric to score each candidate EHR. We would very quickly see development to pass the test and conform to one implicit government design standard, rather than to innovate and please the user. I do not believe that ONC should follow through on their stated goal of doing usability scoring. It would likely provide false assurance to the purchaser while limiting innovation in development.

It is also useful to remember that the community of purchasers in this case (physicians) is an extremely diverse and well educated group. My experience is that a physician's general common sense and personal evaluation would likely exceed any minimum standard for usability that ONC, CMS and NIST could agree upon and execute in time for the stimulus program given that we are already in the middle of it

In addition, measuring usability is not an exact science and codifying it to a simple grade would be potentially misleading. This could have negative impacts on both the purchasers and the developers as well. The following study is representative of the subjectivity that would be difficult if not impossible for ONC to resolve in any time frame that would provide useful input into a purchase decision related to the stimulus program.

- <http://www.elearning-reviews.org/topics/human-computer-interaction/usability/2004-molich-et-al-comparative-usability-evaluation/> -> "The results show that 75% of the 310 reported usability problems were uniquely reported by one team, 29 of which are considered to be serious usability flaws. Only one problem was reported by more than six teams. The authors conclude that the results of usability tests are far from being similar, even if multiple organisations choose to apply the same method to evaluate the same tasks."
- Molich's website with his papers: <http://www.dialogdesign.dk/> extracts from various papers:
  - "Our main conclusion is that our simple assumption that we are all doing the same and getting the same results in a usability test is plain wrong."
  - "The study also shows that there was no practical difference between the results obtained from usability testing and expert reviews for the issues identified. It was not possible to prove the existence of either missed problems or false alarms in expert reviews."

Where government could help the most with regard to usability is not where one might think or what some in the meeting today would ask the government to fund. The single biggest impact on usability of EHRs that could be affected by ONC, CMS and NIST would be in a deeper understanding and consideration as to the impact of confusing or poorly constructed regulations or measures that contort the clinical flows or logical thought processes in unexpected ways. For example, the smoking cessation categories now required under Meaningful Use stage 1. Or measures that don't recognize the unique roles that specialists play or that don't account for the situations where any one provider does not have access to or control the data of the overall care process.

The area of patient safety in EHR development is very important and also an area where government funding designed to document and share best practices could be very beneficial. The Institute for Safe Medication Practices is an excellent example of a group that catalogues safety concerns and provides concrete recommendations for developers to avoid known safety issues.

**In summary, ONC should consider the following:**

1. Promote and organize the wealth of already existing and emerging usability and human factors information for both the community of EHR software developers as well as for those physicians seeking to acquire an EHR.
2. Ask the RECs to act as a resource relating to usability feedback and actual user experience on the products they work with.
3. Promote and reference existing independent industry evaluators that collect real user feedback on usability relating to EHRs – such as KLAS.
4. Develop a simple but effective best practice guide to help clinicians evaluate usability as it relates to their practice and preferences. This guide could easily be updated and informed by experiences captured through RECs as the stimulus program progresses.
5. Continue to support existing and expanding organizations like the Institute for Safe Medication Practices and other Patient Safety Organizations that compile and share best practice information based on actual software use and safety suggestions that would improve the safe use of EHRs including electronic ordering for example.
6. Avoid a potentially flawed approach that a simple scoring system would likely yield.
7. Create a process at ONC to better understand the usability impact of regulatory requirements for physicians and their impact on safe, sane and efficient medical practice.
8. Review and increase transparency in discussions and planning related to usability going forward.

Thank you for considering my responses and feedback.